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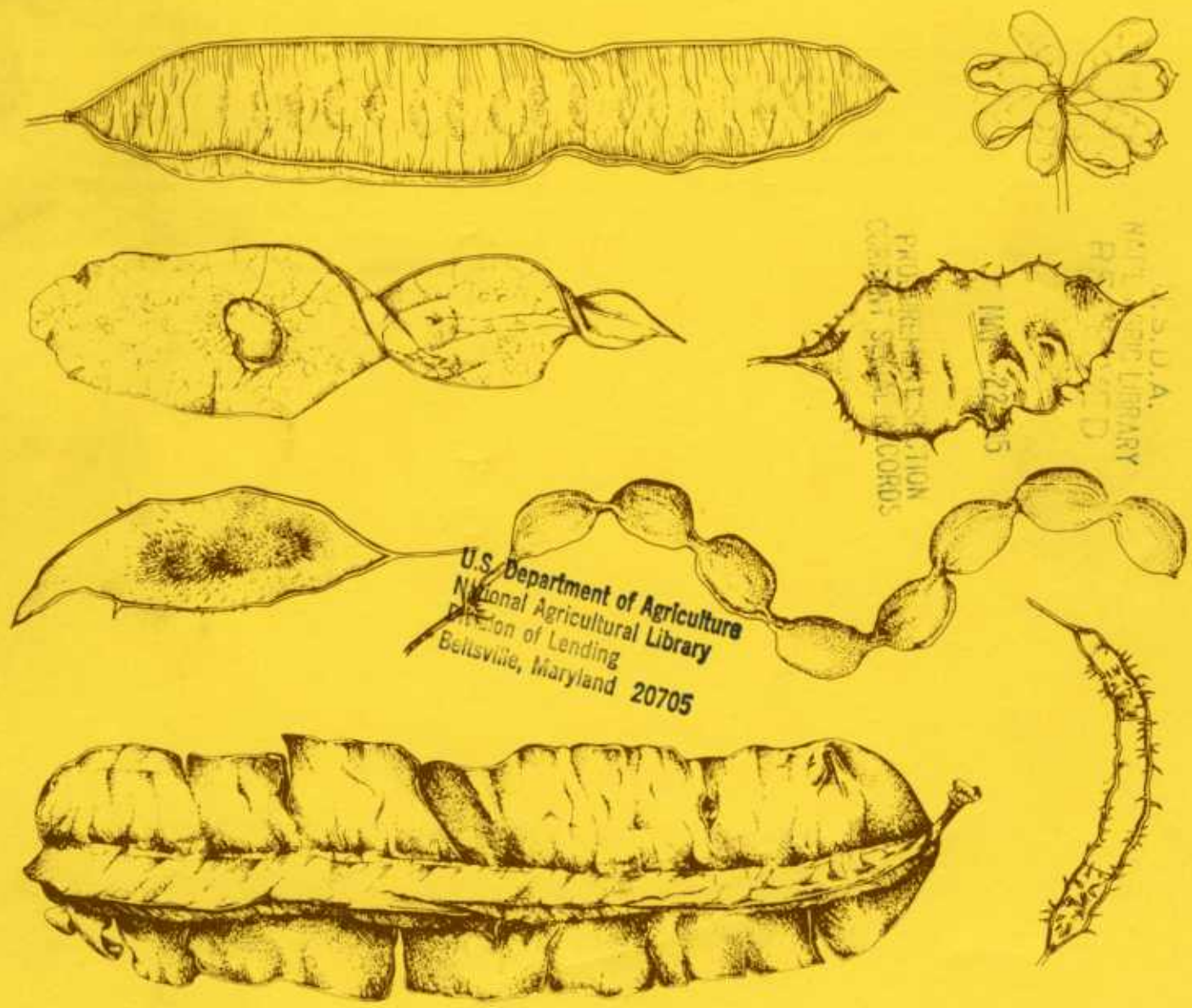
Fruits and Seeds of Genera in the Subfamily Mimosoideae (Fabaceae)



Abstract

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Technical identification of fruits and seeds of the economically important legume plant family (Fabaceae or Leguminosae) is often required of U.S. Department of Agriculture personnel and other agricultural scientists. This bulletin provides relevant information on the mimosoid legumes. New data presented also increase our knowledge of relationships of concern in germplasm search.

Data are derived from extensive sampling of the species of all 64 genera of mimosoid legumes. Three keys provide for (1) the differentiation of mimosoid from other legume seeds, (2) the identification of mimosoid genera based on fruit and seed characters, and (3) the identification of mimosoid genera based on seeds alone.

An updated explanation and discussion of fruit and seed characters precede the generic descriptions. The information on fruit characters extends and corrects that presently in the literature. Nearly all descriptive data on seeds are new.

The lens, a seed topographic feature adjacent to the hilum, previously thought to be diagnostic of the faboid legumes, occurs also among the mimosoids. The presence or absence of endosperm, previously misunderstood, is documented; numerous mimosoid legumes have endosperm. An unrecorded character relating to the positional relationship of the cotyledons and the embryonic axis has been found useful in the generic identification of seeds.

KEYWORDS: Antiraphe, areola, aril, article, Caesalpinioideae, chalaza, cotyledon, cuticle, dehiscence, embryo, embryonic axis, endocarp, endosperm, epicarp, epicotyl, eye, Fabaceae, Faboideae, fracture line, fruit, funiculus, gynophore, halo, hilar groove, hilar groove lips, hilum, hypocotyl, interactive computer, legume, Leguminosae, lens, mesocarp, micropyle, Mimosoideae, pleurogram, plumule, radicle, radicle lobe, raphe, replum, rim-aril, seed, spermoderm, stipe, suture, testa, valve, wing.

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By
Charles R. Gunn

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Contents

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Issued December 1984

Fruits and Seeds of Genera in the Subfamily Mimosoideae (Fabaceae)

by Charles R. Gunn[1]

The Fabaceae (Leguminosae of authors including Isely and Polhill, *1980*)[2] traditionally is divided into three subfamilies: Mimosoideae, Caesalpinioideae, and Faboideae (Faboideae is Papilionoideae in Polhill et al., *1981*). The family comprises 650 genera, has 18,000 species, and is the largest flowering plant family after the Asteraceae and Orchidaceae. However, only the Poaceae rivals the Fabaceae in agricultural importance. The past, present, and future value of the Fabaceae (the legume family) has been documented recently by Duke (*1981*), Isely (*1982*), the National Academy of Sciences (*1979*), Skerman (*1977*), and Summerfield and Bunting (*1980*).

Elias (*1981*), in an overview of the subfamily Mimosoideae, noted that it comprises 64 genera, including 5 unnamed at that time, an unassigned genus, and an unassigned species, and approximately 3,000 species, distributed throughout tropical, subtropical, and warm temperate zones. Nearly two-thirds of the species are found in the genera *Acacia*[3] with 1,200, *Mimosa* with 400-500, and *Inga* with 350-400 species. Over one-half of the mimosoid genera recognized in Polhill and Raven (*1981*) have 10 species or less; 11 of the genera, mostly African, are monotypic. The distributions and generic names and parameters in the section on Synopses of Fruit and Seed Characters are based on data from Polhill and Raven, except as noted.

The purpose of this bulletin is threefold: (1) Expand the morphological data base of Polhill and Raven by presenting for the first time a comprehensive overview of mimosoid fruit-seed characters, (2) include keys, illustrations, and descriptions for accurate and rapid identification to genus of either isolated fruits and seeds or herbarium specimens bearing fruits and seeds but not flowers, and (3) provide accurate fruit and seed data for phylogenetic considerations.

In addition to the pertinent chapters in Polhill and Raven (*1981*) and the generic studies cited elsewhere, the following references, usually of regional floras, were consulted: Aubréville (*1959*), Bentham (*1842*), Brenan (*1963, 1970, 1977*), Britton and Killip (*1936*), Gilbert and Boutique (*1952*), Isely (*1958, 1970a, 1970b, 1971a, 1971b, 1973*), Kostermans (*1954*), Lima (*1982*), Nielsen (*1981b*), and Ross (*1975*).

Unpublished data (pers. commun.) were supplied by reviewers of the tribes Parkieae (Hopkins, 1982), Mimoseae (Lewis, 1981, 1982), Acacieae (Pedley, 1982), and Ingeae (Nielsen, 1981, 1982).

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[2]The year in italic after the author's name refers to Literature Cited, p. 186.

[3]For authors of studied genera and species, see the section on Synopses of Fruit and Seed Characters.

Procedures

Critical materials were authenticated by an expert in the tribe and by recent annotation labels. Authenticated fruit and seed samples, selected to exhibit the range of morphological characters within a genus, were used to prepare keys, descriptions, and illustrations. Samples were documented either by voucher herbarium specimens or by specimens deposited in the U.S. National Seed Herbarium, and a list of these specimens was filed in the Herbarium. Additional fruit and seed samples, many identified by comparison, were used to augment the survey of each genus.

Fruit and seed topography were observed at 10 to 30 magnifications, using a dissecting stereoscopic microscope equipped with an ocular micrometer. Recorded observations were made at 10 magnifications, except as noted.

The text in the section on Synopses of Fruit and Seed Characters was data banked and processed in an interactive Prime 550 minicomputer. Entry of data and commands was accomplished using an in-laboratory Perkin-Elmer 1251 cathode-ray tube (CRT) connected to a dedicated telephone line by a Bell Dataphone 212A accoustical coupler operated at 1200 baud. Printouts were obtained from an in-laboratory Texas Instrument Company Omni 800-820 KSR printer at 120 characters per second (CPS). Figure 1 depicts the data flow between the laboratory and two of the U.S. Department of Agriculture's interactive computers, the Prime 550 and the International Business Machine (IBM) 3033, which processed data using the FAMULUS program. Entry into the IBM computer was made through the time-sharing option (TSO), and communication from the IBM to the Prime was made through the remote job entry (RJE). All computer commands were initiated through the in-laboratory CRT.

In preparing seeds for dissection, mature seeds of representative size and shape were drilled, using a miniature electric drill. The testa was penetrated one or more times, depending on seed size, in areas removed from the embryonic axis. Drilled seeds were placed in a softening solution of 74 percent distilled water, 25 percent methyl alcohol, and 1 percent dioctyl sodium sulfosuccinate (aerosol OT). They were kept in solution for one-half to 24 hours, depending on the consistency of the testa. The testa was easily removed along with the endosperm when present. Embryos were drawn with the aid of a camera lucida fitted on a stereoscopic microscope. Illumination was provided by an above-stage fiber optic system, which split the light into one beam for the microscope and one for the camera lucida.

Drawings were prepared first in pencil and then in India ink on Dupont Cronaflex U-C Tracing Film.

The light photographs were made at the Photography Laboratory, Beltsville Agricultural Research Center (BARC), using 5×7 Kodak Ektapan 4162 sheet film. Mature seeds usually were photographed in face view at 1 magnification and either enlarged or printed contact size, using standard printing techniques.

The micrographs from the scanning electron microscope (SEM) were made at the BARC SEM Unit. In most instances, mature seeds were photographed in face view at 50 and 1,000 magnifications. The seeds were cleaned by hand and attached by adhesive to aluminum specimen stubs and then stored in a desiccator for at least 24 hours before coating. Coating with gold-palladium was done in a Technics Hummer D.C. Sputtering Coater. Chamber pressure was reduced to 20 millitorrs and then flushed five times with argon before chamber stabilization at 100 millitorrs. Coating time was 2 minutes at an operating potential of 1,600-2,000 volts and a current of 10 milliamperes. Although measurements were not made of its thickness, the gold-palladium coat was not deemed excessive for the desired magnifications of 50 and 1,000. Seeds were scanned in a Hitachi SEM, model S430. Accelerating voltage was 15 kV, final aperature size 100 μm, and a working distance to the specimen of 15 mm.

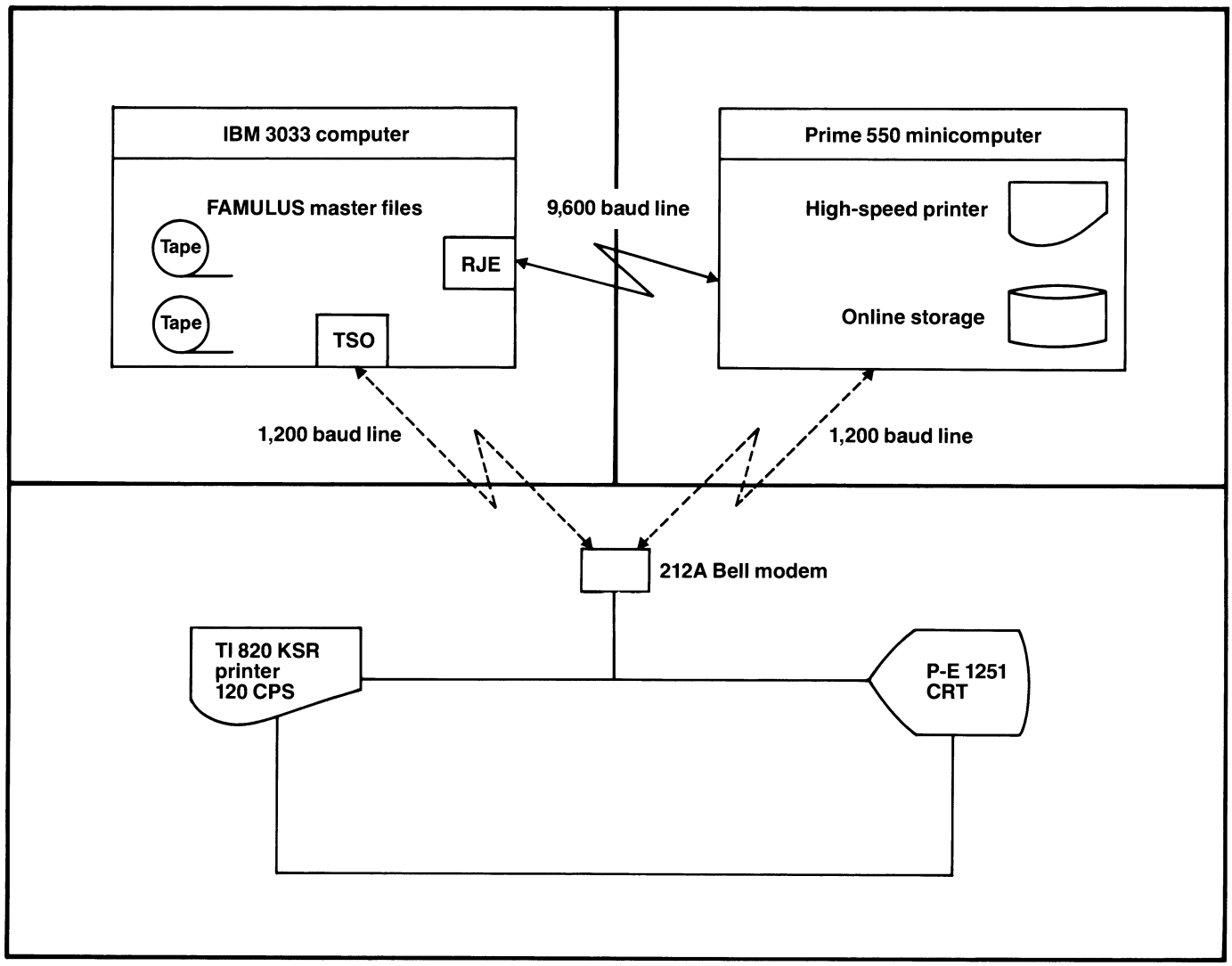


FIGURE 1.—Data flow between in-laboratory terminals and two remote USDA interactive computers. (For explanation of abbreviations, see p. 2.)

Fruit Morphology

There is a paucity of fruit morphological data at the family and subfamily levels when compared with seed morphological data. In the most recent treatment of the genera of the Fabaceae (Polhill and Raven, *1981*), no summary of fruit characters was given at the subfamily level. Both Cronquist (*1981*) and Hutchinson (*1964*) mentioned such generalized and noncircumscribing fruit characters as "commonly dry," "2-valved," "sometimes indehiscent," "breaking transversely," "a typical legume," "sometimes winged." Lima (*1982*) provided a limited classification and discussion of mimosoid fruits, South American taxa of tribe Mimoseae.

The mimosoid pistil comprises a single ovary, which is usually unilocular. Multilocular ovaries occur in three mimosoid genera—*Affonsea, Archidendron,* and *Inga* of the tribe Ingeae.

Mimosoid fruit characters have been summarized by Burkart (*1952*) for the 18 genera occurring in Argentina, by Bravato (*1974*) for the 19 genera in Venezuela, by Lima (*1982*) for South American genera in tribe Mimoseae, and by Brenan (*1959*) for the 20 genera in tropical East Africa.

Mature, dry fruits were studied, and their characters are discussed here in the order given in the section on Synopses of Fruit and Seed Characters. Selected fruit characters are illustrated in figure 2. In the following fruit discussions, the number in parentheses after a character is the number of genera exhibiting the character. The total number of genera for any suite of characters may exceed 64 (the number of mimosoid genera), because a genus may be variable for the character. For example, a genus may have species with dehiscent, tardily dehiscent, and indehiscent fruits. The fruit data are presented in this order:

Fruit—size, declination, twist and outline, margins, apex, base, stipe, transection, density.

Valves—dehiscence, adnation to sutures, seed chamber visibility.

Epicarp—sheen, color, hairs, surface, exfoliation.

Mesocarp—texture, density.

Endocarp—sheen, color, septation.

Seeds—number per fruit, position, separation, number of series.

Funiculus—length, thickness, shape; for *Acacia* and *Pithecellobium*, notes about the aril, which may be present on seeds of some species.

Fruit

Size. Fruit size is recorded in centimeters for length, width, and thickness and mostly as a range. Length is measured from the apex to the base of the stipe, width at the widest part of the fruit, and thickness at the thickest part of the fruit. Both width and thickness usually are measured with a caliper prior to dehiscence.

The shortest mimosoid fruits (0.3 cm) are found in *Calliandra* and the longest (200 cm) in *Entada*, which are among the longest, if not the longest, in the Fabaceae.

Declination. Fruit declination, prior to dehiscence, is categorized as coiled around a central lumen and includes ½-coiled (8), 1- to 1½-coiled (8), and several-coiled (5); spirally coiled with no lumen (2); curved (26) and slightly curved (12); falcate (2); S-curved (1); and straight (47).

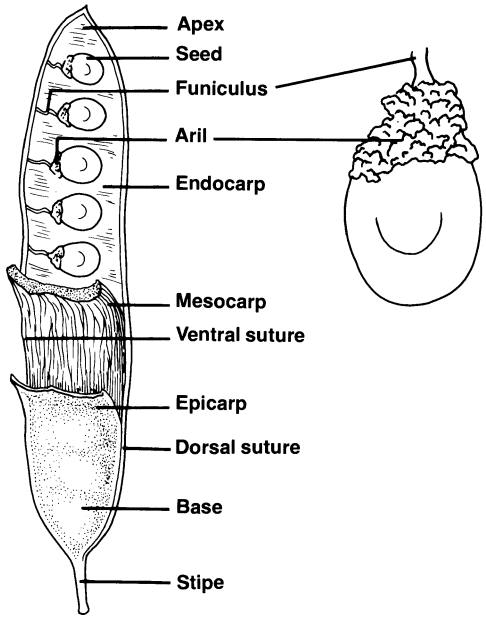
Twist and outline. Fruit outlines occasionally are modified by one or more twists (19), which are not related to dehiscence. Basic fruit outlines prior to dehiscence and disregarding declination are categorized as circular (1), dolabriform (1), elliptic (1), falcate (1), linear (40), moniliform (8), oblanceolate (2), oblong (44), obovate (3), ovate (4), quadrangular (1), reniform (1), and semicircular (1).

Margins. Fruit margins range from constricted (31) to slightly constricted (21) or not constricted (46) along both margins, or one margin may differ from the other. Fruit margins may be embellished by bristles (1), fringes (1), prickles (2), or wings (2).

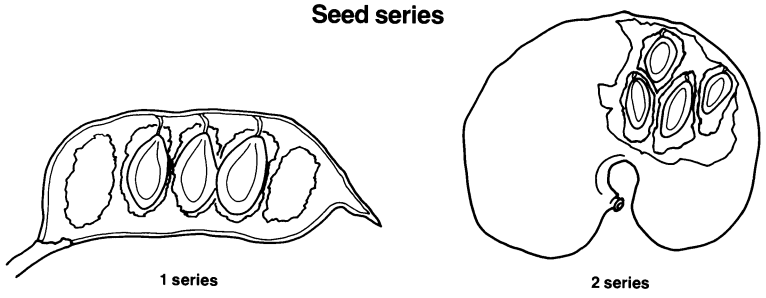
Apex. Fruit apexes may be blunt (1), emarginate (2), rounded (45), short tapered (32), tapered (12), or truncate (2). Four genera have an indurate style or part of the style and are distinctly beaked.

FIGURE 2.—Selected fruit terms for the subfamily Mimosoideae.

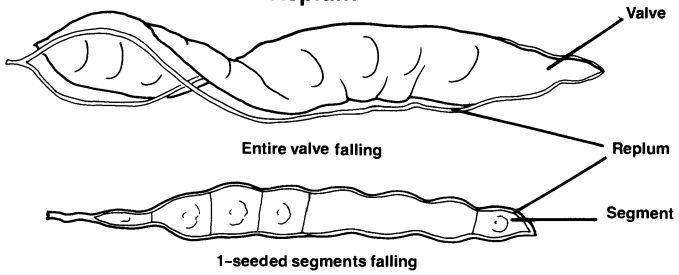
Mimosoideae fruit terms



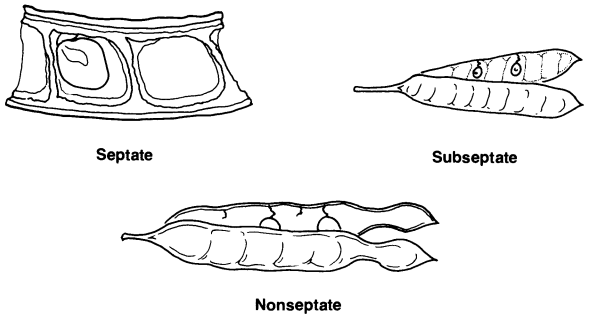
Seed series

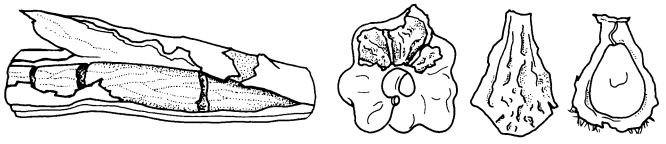


Replum



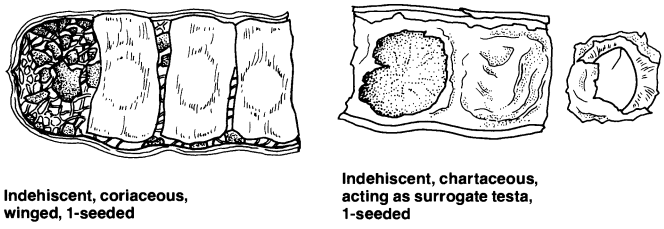
Endocarp





Indehiscent, spongy, 1 or more seeds

Indehiscent, lignified, 1-seeded

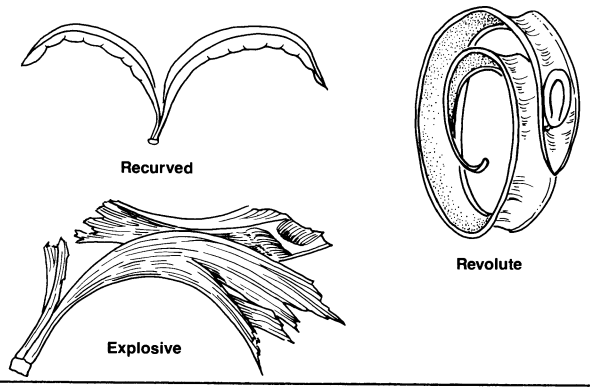


Indehiscent, coriaceous, winged, 1-seeded

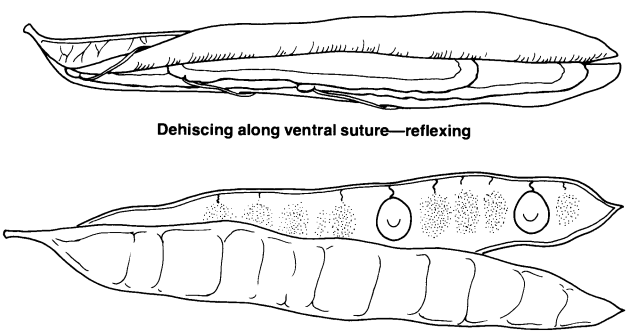
Indehiscent, chartaceous, acting as surrogate testa, 1-seeded

Dehiscence

Active



Passive



Base. Fruit bases, not including the stipe, may be emarginate (1), rounded (25), short tapered (34), tapered (19), or long tapered (8).

Stipe. Fruits may be stipitate (40), substipitate (30), or nonstipitate (18). Stipes or gynophores may range in length from 5 to 100 mm. Fruits with stipes less than 5 mm long are arbitrarily categorized as substipitate.

Transection. Fruit transections are categorized as compressed (42), cruciform (1), flattened (32), quadrangular (3), and terete including subterete (13).

Density. Fruit density is categorized as chartaceous (4), coriaceous including subcoriaceous (43), fleshy (4), ligneous including subligneous (30), membranous (5), succulent (1), and tough-fleshy (1).

Valves

Dehiscence. Fruits may be dehiscent to tardily dehiscent (53) or indehiscent (27). If dehiscent, valves initially may open apically (31), medially (20), or basally (3) along both sutures or one suture. During dehiscence, valve openings range from elastic and revolute to scissorlike, and valves may twist or not. Tardily dehiscent valves are part of some *Inga* fruits, which scarcely open or burst irregularly, and *Schleinitzia* fruits, which gape along the ventral suture and finally dehisce. If indehiscent, valves may remain intact; they may separate transversely into indehiscent one-seeded segments (7); the exocarp and mesocarp may fall from the unopened endocarp (*Plathymenia*); or the exocarp and mesocarp may disintegrate, releasing the endocarps in some *Prosopis* species. Unopened endocarps fall from indurate mesocarps in *Wallaceodendron celebicum*. The valves usually remain attached to the sutures (57), and occasionally they separate from the sutures (11). When the valves or valve segments fall, the empty frame formed by the indurate sutures is called a replum (8). Seed chambers are either visible (52) or invisible (30).

Dehiscence may be categorized as active or passive. The fruit with an active dehiscence opens with enough force to cause the valves to break, twist, or become revolute. On the other hand, fruits with a passive dehiscence open without damaging or changing the valve configuration. The type of dehiscence and the subsequent valve configuration usually are governed by the absence or presence of mesocarp fibers. It is their structure and position relative to the length of the fruit that cause active dehiscence. Fruits of the eight genera with winged seeds open along the ventral suture (folliclelike), permitting the seeds to dangle from the fruits by their long funiculus.

Adnation to sutures. The valves usually remain attached to the sutures (54) even after dehiscence. Occasionally they fall from the sutures leaving an indurate replum (8), and rarely tearing from the suture (*Pentaclethra*), or remaining attached to sutures, or irregularly breaking from sutures (*Dichrostachys*). For illustrations of selected terms, see figure 2.

The ventral or adaxial suture is the placental suture, where the edges of the hypothetical foliar carpel come together. The dorsal suture is the abaxial suture. These terms may be reversed in some legume literature (Isely, pers. commun., 1982).

Seed chamber visibility. Externally the seed chambers may be invisible (17), invisible to visible (11), or visible (36).

Epicarp

Externally the epicarp may be dull (55) or glossy (23) and is usually various shades of brown or brown in combination with other colors (62). Other colors include black (13), red (4), and gray, green, orange, purple, and yellow (1 each). *Anadenanthera* may exhibit a mottled or monochrome epicarp, and the other genera have essentially monochrome epicarps. Epicarps may be glabrous (52), glabrate (9), prickly (2), and pubescent (43), including glandular (4), puberulent (3), tomentose (2), velutinous (5), and with stellate hairs (2). The surface may be reticulate (32) or bear other venation patterns (18); it may be pitted (1), rugose (6), scaly (4), shagreen (11), or smooth (4). The epicarp during dehiscence or with maturity may exfoliate (21), partially exfoliate (3), or not exfoliate (25).

Mesocarp

The mesocarp may be absent (36), absent or present (7), or present (21). If present, it ranges from spongy (7) or mealy (2) to fibrous (19) or solid (6) and from coriaceous (3) to subligneous or ligneous (21) or vitriol (1).

The energy for active or elastic dehiscence usually arises from the mesocarp. Whereas a well-developed mesocarp controls the force and direction of active dehiscence, one should not conclude that fruits with a well-developed mesocarp are dehiscent. For example, see the description of *Wallaceodendron*. The thickened sutures of *Calliandra* provide the mechanism for its active dehiscence.

Endocarp

The endocarp is usually dull (62), rarely glossy (8), and usually various shades of brown or brown in combination with other colors (65), rarely (no more than 3 genera per color) a bright color, such as red, orange, or white, or a darker color, as black, purple, or gray. The endocarps of some species in four genera are mottled, the remainder monochrome. Usually the surface around, under, and over the seeds is smooth, though some inner endocarp surfaces may be cobwebby, lined, mealy, reticulate, rugose, or scurfy. The inner surface rarely exfoliates. The endocarp may be transversely septate (21), subseptate (27), or nonseptate (40).

The endocarp assumes special significance in *Parkia, Plathymenia, Prosopis,* and *Wallaceodendron*. The texture of the *Parkia* endocarp is discussed in the Notes of that genus. The one-seeded winged endocarp segments of *Plathymenia* and *Wallaceodendron* are functionally the same though their mode of separation from the remainder of the legume is different. In *Plathymenia*, the exocarp and mesocarp may fall from the endocarp segments, whereas in *Wallaceodendron,* the endocarp segments fall from the mesocarp. The lignified one-seeded endocarp segments of *Prosopis* were labeled articles by Burkart (*1976*) and are released by disintegration of the epicarp and mesocarp.

Seed Number and Position in Fruit

The number of seeds per fruit varies from 1 to at least 35. The seeds are numerous in *Acacia* according to some of the literature cited with its treatment. Seed lengths in relation to fruit lengths may be parallel (17), oblique (18), or transverse (43). Seeds overlap each other in only five genera and are in two or more series in only three genera.

Of the five genera with overlapping seeds, four have flattened, winged seeds. The shape of these seeds is not affected by the adjacent seeds. This is not always true in the other genus with overlapping seeds. *Schrankia* seeds may be concave at the apex and on the opposite side at the base. These concave areas are formed by the pressure of adjacent overlapping seeds.

Funiculus and Aril

The funiculus ranges from 1 to at least 50 mm long and from filiform (45) to thick (28) or partially filiform and partially thick (*Pithecellobium*). The funiculus is coiled (5), contorted (8), convoluted (1), curved (16), deltoid (3), hooked (11), plicate (22), S-curved (14), or straight (10).

Fruits of some *Acacia* species and all *Pithecellobium* species (Nielsen, pers. commun., 1982) have an enlarged, indurate funiculus,which remains adnate to the dehisced seed and is labeled an aril. Arils may be cap shaped, clavate, foliaceous, elongate, encircling, massive, one- to five-plicate, or rugose. Elias (*1974*) described mimosoid seeds as "often arillate (the aril often fleshy)" even though of the 64 genera only some *Acacia* species and all *Pithecellobium* species have arillate seeds. Arils are a factor in seed dispersal.

Seed characters, especially testa anatomy, support the concept of one family as advocated by de Candolle (*1825*) as well as his bipartite division of the family. He separated the Curvembriae with a curved embryonic axis from the Rectembriae with a straight embryonic axis. Although the curvature of the embryonic axis now is not regarded as the best character for primary division in the family, it is an indicator of better protection for the radicle and may form one of a combination of seed characters, especially hilar characters, used to separate the Faboideae from the Caesalpinioideae and Mimosoideae. Another character used to support this bipartite division is the presence of a visible lens. Because there are seeds in the three subfamilies with visible lenses, this is no longer a delimiting character. Selected seed characters for the subfamilies are enumerated in the section Seed Key to Three Subfamilies of Fabaceae and are shown in figure 3.

Seed characters yielded to floral and vegetative characters when Bentham and Hooker (*1865*) created a third suborder by dividing the Rectembriae into the Caesalpinieae (suborder II) and the Mimoseae (suborder III). Taubert (*1894*) retained this tripartite division, treating the suborders as families and moving the Swartzieae, containing taxa with a curved embryonic axis, from the Faboideae to the Caesalpinioideae. Corner (*1976*) recognized four subfamilies, the fourth being the Swartzioideae. Cowan (*1981*) returned the Swartzioideae to the Faboideae as its first tribe, Swartzieae. This tripartite division has remained stable, except for the conclusion of El-Gazzar and El-Fiki (*1977*) that the bipartite division of de Candolle is superior to the tripartite division of other authors.

Renewed interest in legume seed morphology occurred in the 20th century. Capitaine (*1912*), noting the poor representation of mimosoid seeds in his collection, included only five mimosoid genera in his study and was unable to draw conclusions. Boelcke (*1946*) studied the seeds of 13 mimosoid genera, comparing and contrasting them with 20 caesalpinioid genera. Boelcke's key, detailed parallel descriptions, and illustrations represent one of the first modern legume seed studies. His work was reproduced and expanded to include faboid genera by Burkart (*1952*).

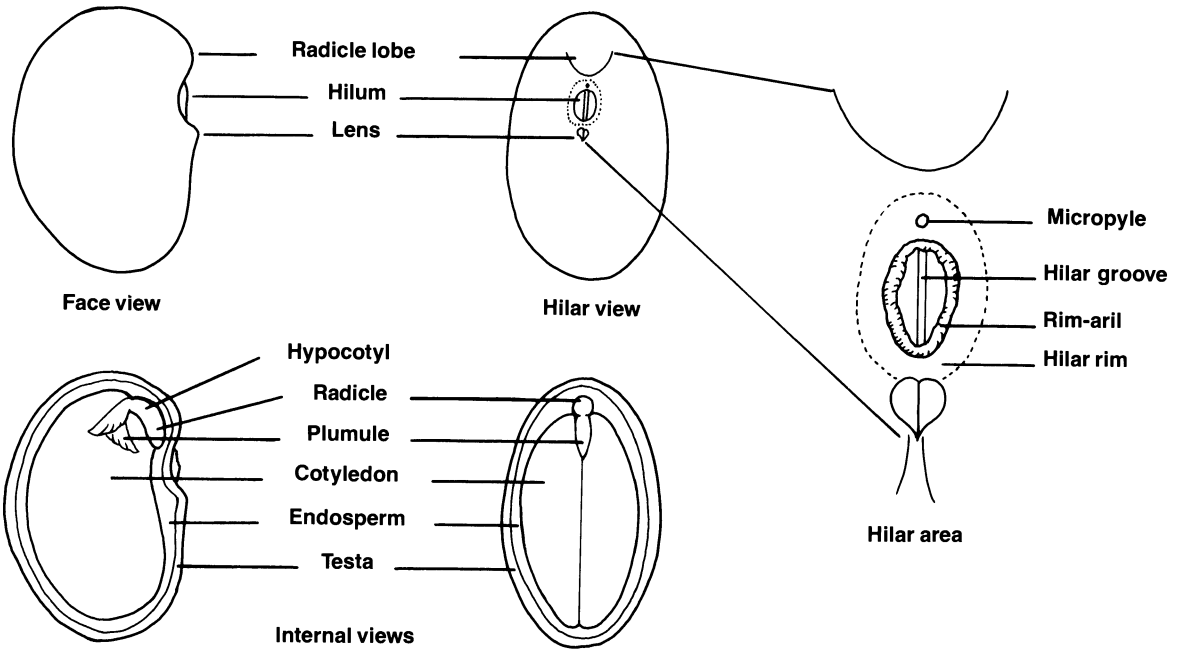
The multifamily studies of Martin (*1946*) and Isely (*1947*) laid the basis for the overview by Gunn (*1972*). Although Corner (*1951, 1976*) primarily dealt with an anatomical study of seeds, he discussed and illustrated several morphological legume characters. Isely (*1955*), without citing the foregoing literature, restated the similarities and differences among the seeds of the three subfamilies. One of his students (Kopooshian, *1963*; Kopooshian and Isely, *1966*) confirmed the similarities and differences, using a much larger sample of genera. The reports of Isely and Kopooshian laid the basis for Gunn's studies (*1981, 1982*) as well as for this bulletin. In his 1981 and 1982 reports, Gunn summarized the seed characters for 510 legume genera, including 53 mimosoid genera.

In her study of fruits and seeds of 18 Venezuelan mimosoid genera, Bravato (*1974*) noted that though fruits do not exhibit taxonomically important characters (Gunn disagrees), seeds do exhibit phylogenetically important characters. She cited *Acacia, Calliandra, Piptadenia* s.l., and *Pithecellobium* as examples. She also noted that some genera have variable seed characters, such as presence or absence of endosperm, pleurograms, or arils. She regarded such genera as heterogeneous, or perhaps as having subgenera with different seed characters. She pointed out that *Acacia* is composed of several segregate genera and that seed data supported the recognition of the segregate genus *Poponox* Rafinesque, with globose seeds containing abundant and encircling endosperm. Using this scenario, seeds of *Acacia* s.s. would not be globose and would have scanty to no endosperm.

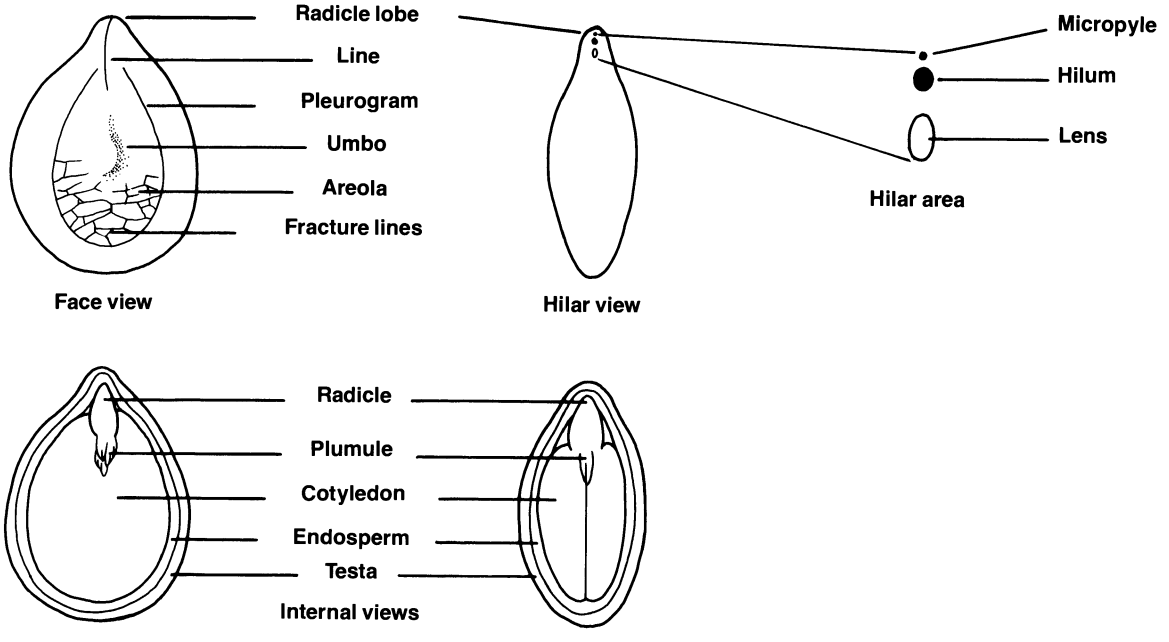
FIGURE 3.—Terms used to describe seeds of the subfamilies Faboideae and Mimosoideae.

Faboideae-Mimosoideae seed terms

Faboideae



Mimosoideae



Mature, dry seeds were studied, and their characters are discussed here in the order given in the section on Synopses of Fruit and Seed Characters. Selected seed characters are illustrated in figures 3-34. The seed outline shown in the box at the upper right of the other illustrations is always at 1 magnification. In the following seed discussions, the number in parentheses after a character is the number of genera exhibiting the character. The total number of genera for any suite of characters may exceed 64 (the number of mimosoid genera), because a genus may be variable for the character. For example, a genus may have species with seeds that are flattened, compressed, and terete in transection. The seed data are presented in this order:

Seed—size, outline, transection.

Testa—sheen, color, surface, thickness, pleurogram, fracture lines, wing, aril.

Hilum—outline, size when needed, surface, occlusion by wing when needed, elevation, position.

Lens when discernible—size, outline, elevation, color.

Endosperm when present—thickness, position.

Cotyledons—condition over or around radicle, amount of radicle exposed.

Embryonic axis—relationship to seed length.

Plumule—visibility.

Seed

Size. Seed size is recorded in millimeters for length, width, and thickness and mostly as a range. Length is measured along the long axis of the seed without regard to hilum position. Width is measured at right angles and in the same plane as the length and at the widest point of the seed. Thickness, or short axis of seed, is measured through the thickest part of the seed.

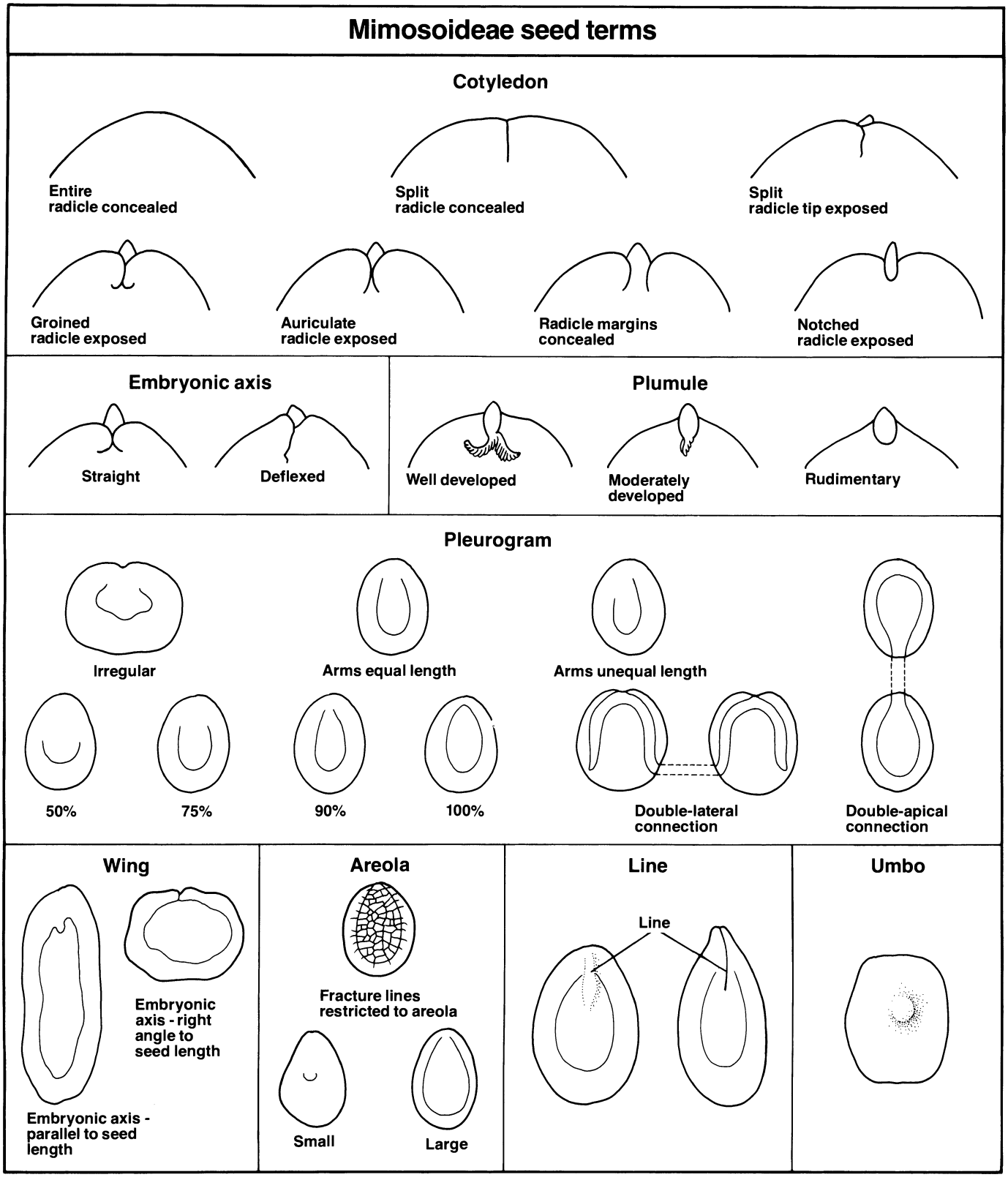
Statements that mimosoid and caesalpinioid seeds are generally longer and wider than faboid seeds are confirmed by this study as well as by Gunn (*1981, 1982*). The seed range is 2.3-130 × 0.9-80 × 0.1-40 mm. Ten genera have species whose seeds reach or exceed 45 mm in length, 9 genera have seeds from 20 to 36 mm, and the remaining genera have seeds under 20 mm. Of the 10 genera with the longest seeds, *Cylicodiscus, Fillaeopsis, Piptadeniastrum,* and *Newtonia* have winged seeds with a chartaceous testa that reach or exceed 100 mm in length and are among the longest, but not the longest, in the family. Like other winged seeds, these seeds are broad and flattened. Seeds of the other six genera that reach or exceed 45 mm in length are proportionally wider and thicker than other long mimosoid seeds and are enclosed by a coriaceous to osseous testa. These genera are *Archidendron, Calpocalyx, Entada, Pararchidendron, Parkia,* and *Pentaclethra*. The smallest mimosoid seeds are in the genus *Mimosa* (2.3 mm long) followed closely by some seeds in *Gagnebina* and *Desmanthus* (2.5 mm long).

Outline. Seed outlines are categorized as circular (23), cuneate (1), elliptic (23), irregular (7), oblong (36), ovate (30), quadrangular (2), reniform (2), rhombic (4), trapeziform (1), or a combination or modifications of these outlines.

Kopooshian and Isely (*1966*) and others have noted that mimosoid seeds are essentially "symmetric and reasonably consistent in shape, usually evenly elliptic." Although elliptic is the third most common shape after oblong and ovate, these shapes are symmetrical and reasonably consistent.

FIGURE 4.—Selected seed terms for the subfamily Mimosoideae.

Mimosoideae seed terms



Transection. Seed transections are arbitrarily categorized as terete with a 1:1 ratio (12), compressed with more or less a 2:1 ratio (53), and flattened with more than 4:1 ratio (23).

The separation between compressed and terete is arbitrary because there is no distinct break between the 2:1 and 1:1 ratios. In addition, some seeds are umbonate, and umbos tend to confuse these transections. On the other hand, flattened seeds are clearly flat. The seven winged-seed genera, as well as *Anadenanthera* with a winglike rim, are flattened in transection and wind disseminated. The other flattened but nonwinged seeds may or may not be wind disseminated.

Testa

Sheen. The testa is glossy in 54 genera and dull in 22 genera. This character disproves statements that the testa of legume seeds is glossy or shiny.

Color. Testa color may change as the seed dries and ranges from black (24), blue (1), various shades of brown or brown in combination with other colors (58), gray (1), green (1), ivory (1), olive (1), red (2), white (4), yellow (1) to various shades or combinations of these colors. In most genera, the seeds are monochrome. Seven genera have mottled or streaked seeds, and three genera have dichrome seeds with two distinct areas of different colors. Lewis (pers. commun., 1982) noted that H. C. de Lima suggested in some dichrome seeds when one section is white that this may be caused by larger air spaces between testa cells. Subtle variations in color occur, especially within and around the pleurogram, and these seeds are not regarded as dichrome.

This study verifies that bright colors are seldom found in mimosoid legumes. Such colors as red, green, ivory, white, and yellow are sufficiently infrequent so that they may be used as key seed characters. Animals are thought to have a role in disseminating brightly colored seeds.

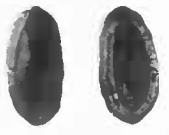
Surface. Seeds of four genera have indurate endocarp remnants adhering to their testa. The testa surface ranges from cuticle exfoliating or blistering (4) to bearing a fanlike reticulation (1), or it is longitudinally one- or two-grooved (1), pitted (11), pustular (1), rugose (25), sculptured (1), shagreen (7), smooth (42), smooth with umbo and line (3), striate (3), and sulcate (1).

The testa is regularly absent from dehisced seeds of some species of *Affonsea, Inga,* and *Parkia.* These seeds have a testa, but during dehiscence the testa remains adnate to the endocarp. The embryo may fall free or fall within an indurate one-seeded endocarp segment. If the embryo falls within the segment, the testa is chartaceous and adheres to the endocarp. These and endocarp segments that contain a seed within an indurate segment are discussed in the section on Fruit Morphology and are illustrated in figure 2.

The testa surface of this legume subfamily is usually reported to be smooth at low magnifications of 10 or less and to have few topographic features. Perhaps lack of such features contributes to the recognition of legume seeds at low magnifications. Two-thirds of the mimosoid genera have at least some seeds with a smooth testa. The remainder of the genera have a testa as described in the next paragraph. Trivedi et al. (*1979*) studied by SEM the testa (their spermoderm) of 10 species in 7 mimosoid genera. They concluded that the testa of 7 of the 10 species in 6 genera had "small irregular ridges and furrows, that is, the surface pattern is of rugose type."

If mimosoid seeds are viewed at higher magnifications, that is, 50 and 1,000, few would have a testa that could be classified as smooth. The illustrations in the section on Synopses of Fruit and Seed Characters contain one or more SEM photographs of selected seeds at 50 and often at 1,000 magnifications. These data are summarized in figures 5-34. The testa in the first column of these illustrations is 1 or 2 magnifications as indicated, 50 magnifications in the second column, and 1,000 magnifications in the third column.

FIGURES 5-19.—Selected mimosoid testa surface patterns (× 1, × 50, × 1,000). 5-7, *Serianthes vitiensis* A. Gray; 8-10, *Pseudoentada patens* (Hooker & Arnott) Britton & Rose; 11-13, *Zygia latifolia* (Linnaeus) Fawcett & Rendle; 14-16, *Anadenanthera peregrina* (Linnaeus) Spegazzini; 17-19, *Newtonia* (American) *suaveolens* (Miquel) Brenan.



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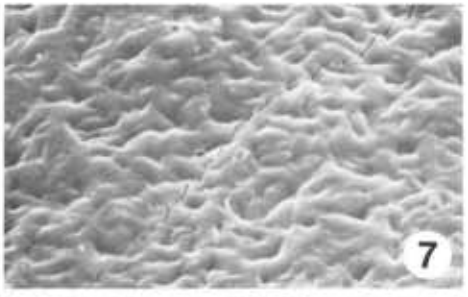

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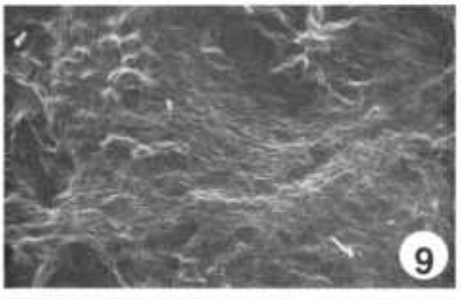

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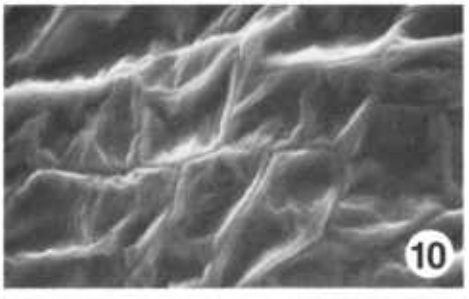

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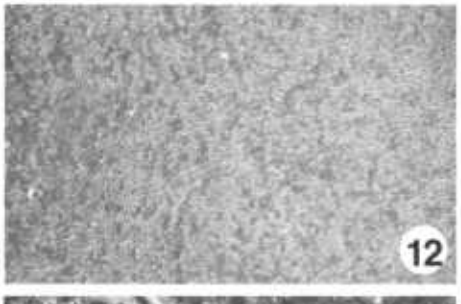

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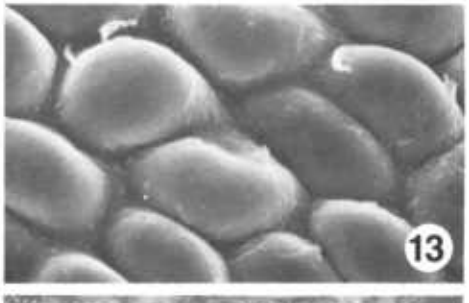

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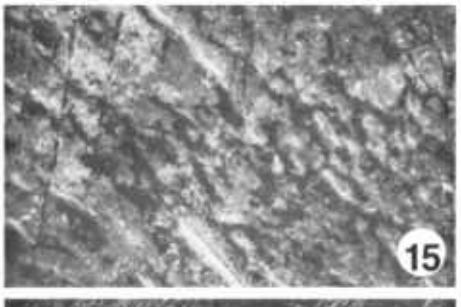

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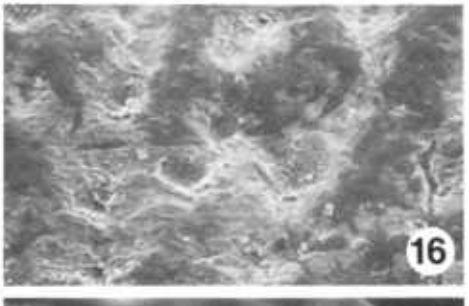

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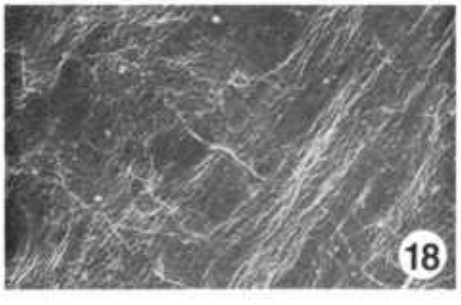

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Both species in figures 5 and 8 are considered to have a smooth testa at 1 magnification. However, when viewed at higher magnifications, the testa is either pitted (figs. 6 and 9) or rugose (figs. 7 and 10). On the other hand, the shagreen testa of *Zygia latifolia* is correctly classified at any of the three magnifications (figs. 11-13). The striate testa of *Anadenanthera peregrina* (figs. 14-16) and the rugose testa of *Newtonia* (American) *suaveolens* (figs. 17-19) also remain correctly classified at the three magnifications; whereas *Aubrevillea platycarpa* (figs. 20-22) has a reticulate testa that is correctly classified at the three magnifications, but the pitted testa seen in figures 23-25 is variable. The pits in these figures are the same type of stomate pits described by Rugenstein and Lersten (*1981*). However, the pits of figures 26-31 are minor depressions in the testa best seen at 1,000 magnifications. The longitudinal grooves are not discernible at 1,000 magnifications in figure 31, though discernible at 2 magnifications. The blistered cuticle of *Desmanthus interior* is visible at the three magnifications (figs. 32-34).

Thickness. Testa thickness is categorized as osseous (30), coriaceous (25), and chartaceous (19).

Testa thickness may be determined by measurement, but this is difficult to do with a stereoscopic microscope at 30 magnifications. The dry testa thickness is determined by a simple flex test: Chartaceous testa breaks, coriaceous testa bends, and osseous testa resists bending. This technique is similar to the one used over 100 years ago by Sempolouski (*1874*).

Pleurogram

Pleurograms may be absent (25), absent or present (8), or present (31). They are usually discrete on each face of the seed, but they are connected either apically or marginally in some species in five genera. Although the connection across the apex or margin may be tenuous, the ends of the pleurogram flair and reach the edge of the seed rather than approaching each other or uniting on one face. Discrete pleurograms are categorized as 100 percent (11), 90 percent (14), 75 percent (20), and 50 percent (6). Pleurogrammatic terms are illustrated in figure 4.

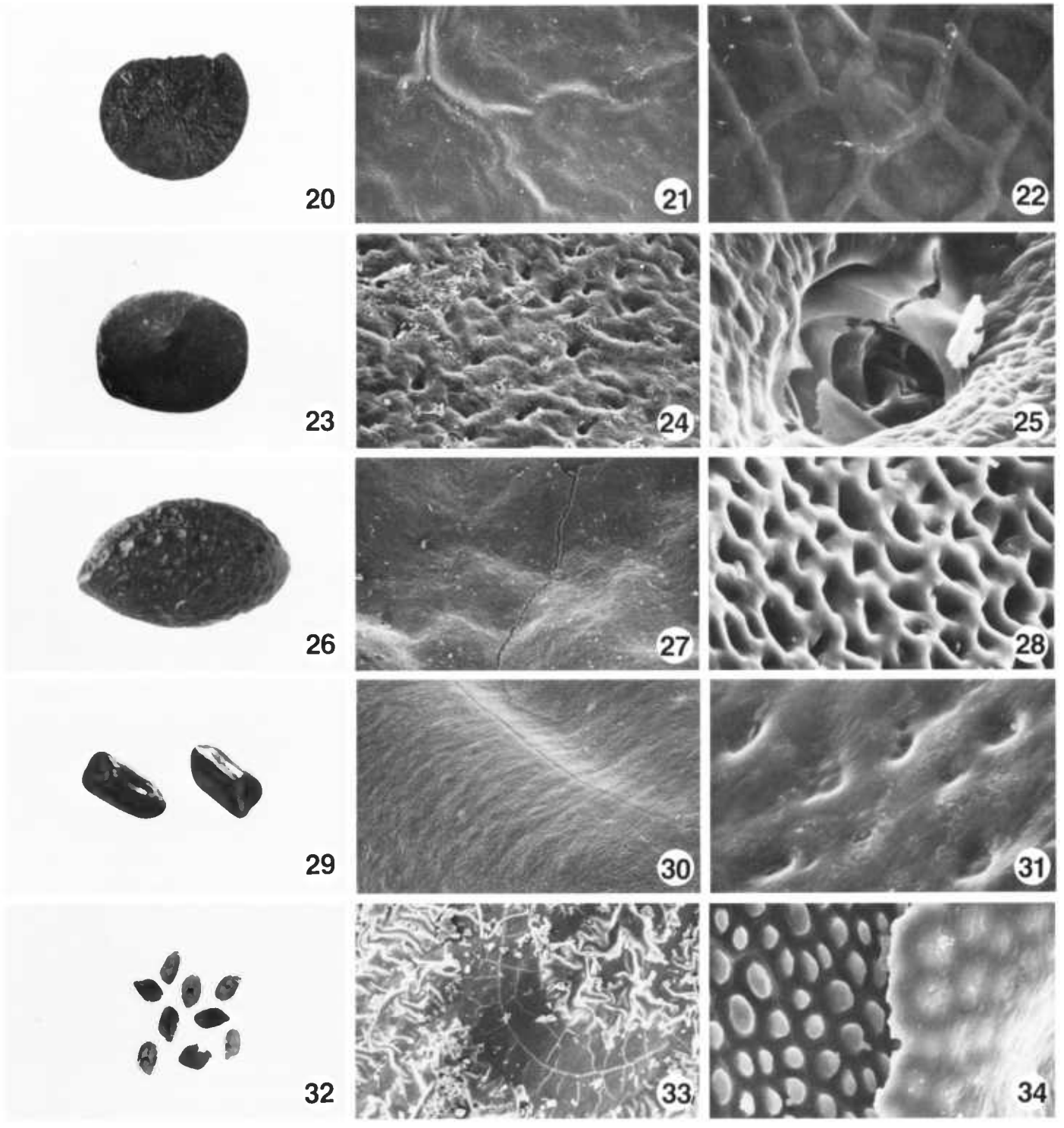
When considering all spermatophyte families, pleurogrammatic seeds are rare, except in the Fabaceae and Cucurbitaceae. Corner (*1976*) noted that "most modifications of the ovule in the course of its development into the seed affect the hilum, the chalaza (lens), or the periphery." Few affect the faces or lateral sides of seeds and these are pleurograms (face lines of Isely, *1955*; light lines from the early 19th century; linea fissura of Boelcke, *1946*; and linea sutura of Capitaine, *1912*).

The pleurogram is absent in the subfamily Faboideae and always present in 9 percent and sometimes in 4 percent of the genera in the Caesalpinioideae. As previously noted, pleurograms are present in 31 genera and absent or present in 8 genera of the Mimosoideae. The mimosoid pleurogram is a gaping break in the exotestal palisades, and it has a uniform origin and usually a uniform shape. The pleurogram may be close to the margin (never along the margin) or interior and small in relationship to seed length and width. Statements have been made to the effect that mimosoid pleurograms function as a hygroscopic valve. There is no documentation of this theory. However, during imbibition, the testa often separates along the pleurogram. This area encompassed by the pleurogram is labeled the areola and usually has the same surface texture as the testa outside the pleurogram. Occasionally the texture of the areola may have subtle to distinct differences when compared to the testa on the outside of the pleurogram.

Fracture Lines

Fracture lines are absent (39), absent or present (16), or present (10). They are formed during seed maturation and are thought to be the results of seed shrinkage during the internal drying process. They are cracks in the cuticle, which is a waxy or fatty coat that covers the testa and is relatively impermeable to water. Isely

FIGURES 20-34.—Selected mimosoid testa surface patterns (× 2, × 50, × 1,000). 20-22, *Aubrevillea platycarpa* Pellegrin; 23-25, *Elephantorrhiza suffruticosa* Schinz; 26-28, *Cojoba arborea* (Linnaeus) Britton & Rose; 29-31, *Schrankia leptocarpa* de Candolle; 32-34, *Desmanthus interior* (Britton & Rose) Bullock.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(*1955*) described fracture lines as "contiguous, curving lines of translucent cracks . . . and more or less obscuring the cellular surface beneath." This network of fracture lines is not found on the faces of faboid seeds. A few faboid seeds have fracture lines adjacent to the hilum. Faboid seeds usually have a thinner cuticle than most mimosoid and caesalpinioid seeds. The relationship of fracture line formation to cuticle thickness has not been established. Some of the seeds with the thickest cuticles do not have fracture lines. Fracture lines are present on the faces of seeds in 30 percent of the mimosoid genera and 26 percent of the caesalpinioid genera. In the Mimosoideae, fracture lines within the areola do not always match those on the outside of the areola area.

Wing

Winged seeds were found in eight mimosoid genera. Those in *Anadenanthera colubrina* and *Archidendropsis* spp. have a winglike rim up to 2 mm wide.Two winged seeds are illustrated in figure 4.

Winged seeds are rare in the Fabaceae. They are restricted to the Mimoseae in the Mimosoideae and to the Caesalpinieae and Detarieae in the Caesalpinioideae. These wings may be well or poorly developed (winglike rim) and are associated with flattened seeds bearing a chartaceous testa and cotyledons notched so that the radicle is exposed. The several authors who described "winged seeds" in the genus *Amburana* (Sophoreae, Faboideae) were depicting an inner part of the fruit, which regularly separates from the outer part. The nonwinged seed is borne within this "winged fruit."

The species of eight mimosoid genera consistently have winged seeds. Winged seeds of some species of the African genera *Cylicodiscus, Fillaeopsis, Newtonia* s.s., and *Piptadeniastrum* reach or exceed 100 mm. The seeds of the remaining genera—*Indopiptadenia* of India and Nepal and the South American genera *Monoschisma, Newtonia* of America, and *Parapiptadenia*—do not exceed 30 mm in length. Upon dehiscing, seeds dangle from up to 40-mm filiform funiculi until transported by gravity, wing, or both.

Aril

Arillate seeds are restricted to some *Acacia* species and all *Pithecellobium* species. Arils are discussed with the funiculus in the section on Fruit Morphology under the heading Funiculus and Aril.

Hilum

Hilum outlines are categorized as circular (3), cuneate (1), triangular (1), elliptic (4), irregular (1), linear (2), oblong (2), and punctiform (60). The lengths of shapes other than punctiform are recorded in millimeters. The hilar surface may be concealed by a funicular remnant (30), exposed (31), or occluded by the seed wing (8). The hilum is usually flush (49), raised (7), or recessed (13). Seeds of a few genera have a halo (4) around the hilum, or the hilum may be associated with a slight depression (2). The hilar position in relation to the radicle tip may be apical (29), subapical (35), apical according to radicle tip but marginal according to seed length (7), and marginal (4).

The mimosoid hilum is simple and an unspecialized structure when compared with the faboid hilum and is usually described as small or punctiform. There is no tracheid bar, rim-aril, or hilar split usually found associated with the faboid hilum. The common mimosoid hilar outline is punctiform and, even with collateral hilar characters, has little diagnostic value. On the other hand, the other hilar outlines are infrequent and, even without collateral hilar characters, have diagnostic value.

There is an ongoing debate concerning the correct orientation of mimosoid seeds. If seeds are oriented in isolation, a person usually would orient the radicle so that it would point downward, causing the hilum to be downward or nearly so. Barneby and Hopkins (pers. commun., 1982) believe "that the hilum is always structurally basal and that this is not altered by displacement relative to the ventral axis of the pod." On the other hand, if seeds are oriented as they are in the legume or pod, then the hilum would be upward, because seeds are suspended from the funiculus along the ventral suture. The suspended ovule forms the typical "tear-drop shaped" mimosoid seed. Considering both the seed and the legume, the correct orientation of mimosoid seeds is with an upward radicle, thus an upward hilum. This same scenario applies to seeds of the other two subfamilies, where the better seed orientation is an upward radicle.

Lens

The lens ranges from not discernible (30) to barely discernible (1) or discernible (33). If discernible, its length is recorded in millimeters. Lens outlines are categorized as circular (8), triangular (6), elliptic (26), irregular (3), linear (13), oblong (5), ovate (3), punctiform (1), and rhombic (1). The lens may be flush (15), groove (1), mound (27), or pit (4), and may be within a depression (3) or with a halo or patch (4). The lens is usually a shade of brown, or the color of the testa, or lighter to darker than the testa. It is seldom black, red, white, or yellow.

Pitot (*1935*) limited the term "lens" (strophiole of authors) to the Faboideae in the Fabaceae and labeled it a protuberance. He defined it as "all reinforcements of normal tissues of the seed situated between the hilum and the chalaza, on the trajectory of the principal vascular bundles." The lens is commonly a mound of tissue, often discolored, on the cotyledonary lobe, which may be adnate to the faboid hilum or separated as far as the opposite side. By this definition, seeds of the Mimosoideae and Caesalpinioideae have no lens. This definition is rejected. Seeds in the three subfamilies have a lens, albeit usually conspicuous and dome shaped in the Faboideae and generally inconspicuous in the Mimosoideae and Caesalpinioideae.

Also rejected is Pitot's statement that the lens is an important feature in the declination of the embryonic axis. Presence or absence of a visible lens is not related to this declination. Had Pitot read the warning in the seed description of *Mimosa pudica* Linnaeus by Capitaine (*1912*), he might have reconsidered his conclusion. Capitaine warned that "on the raphe side below the true hilum, a depressed spot is almost always found which may be mistaken for the hiloid spot. When the funiculus is still adherent, there is no doubt, but when the hilum is exposed and convex, confusion starts since the hilum is most often very small in size. As a result, the spot in question is freely considered as the hilum, and the true hilum as the micropyle." This spot that looks like the hilum is the lens.

Dell (*1980*) described and illustrated the "strophiole" of *Albizia lophantha* (Willdenow) Bentham. The description and SEM's are of a lens that is often called a "strophiole," a term I reject as confusing.

The mimosoid lens is discernible in about 50 percent of the mimosoid genera. When the flattened seeds are not considered (they do not have discernible lenses in any subfamily), the percentage rises to 65. The discernible lens is usually a different shade from the rest of the testa and may be elevated, flush, or depressed.

Endosperm

The endosperm is absent (32), absent or present (6), or present (26). When present, it is categorized without measurement as thick (9) or thin (17), and adnate to the testa (21), a disk atop cotyledons (1), or encasing the embryo (5).

Reports of the presence of endosperm in legume seeds have been confusing, primarily because of the absence of endosperm in seeds of many cultivated legumes, the ones most commonly studied. Seeds of most legumes that are terete or compressed have endosperm, which varies from a trace adnate to the testa and adjacent to the radicle to encasing the embryo and perhaps thicker than both cotyledons.The endosperm is usually hard or "horny" when dry and somewhat glossy and opaque. When the testa is penetrated and the seed is soaked, the endosperm becomes gelatinous and increases in volume. This volumetric increase along with the swelling of the cotyledons combine to rupture the testa. It is usually believed that phylogenetically primitive seeds contain more endosperm—often massive amounts—than more advanced seeds.

Endosperm is not distributed uniformly through the Mimosoideae, and this has lead to confusion. Both Elias (*1974*) and Keay (*1958*) reported these seeds to have scanty or no endosperm. On the other hand, Bentham (*1845*) used the presence or absence of endosperm to divide the Mimosoideae (his Mimoseae) into Eumimosoideae with endosperm and Adenanthereae without endosperm. Winged seeds regardless of subfamily have no endosperm, and if the seven mimosoid genera with winged seeds are not considered, then there are about as many mimosoid genera with as without endosperm. Endosperm is least likely to be found in the 22 genera of the Ingeae, which according to Polhill and Raven (*1981*) are the most advanced. *Havardia* and *Paraserianthes* consistently have endosperm. In 5 other genera the endosperm may be present or absent, and in the remaining 15 genera the endosperm is absent.

Cotyledons

Cotyledons over the radicle may be auriculate (20), notched (13), split and with a basal groin (11), or split without a basal groin (28), and entire in some species of *Inga*. Cotyledons may conceal the radicle (21), conceal all but the tip of the radicle (30), or not conceal or essentially not conceal (only concealing margins) the radicle (19). These terms are illustrated in figure 4. Only cotyledons that are not smooth are described. Their topography is concave at apex or base (*Schrankia*), fanlike reticulation (*Pentaclethra*), folded (*Wallaceodendron*), or rugose (2). Cotyledons may be of two sizes in *Albizia*. Blue-green cotyledons are found in *Abarema*. Smith (*1983*) studied the anatomy of the cotyledon.

As previously noted, cotyledons notched so that the radicle is exposed correlate with flattened seeds. The auricles and splits, simple or basally groined, appear to be a device to keep the cotyledon from being ruptured when the radicle expands and elongates during germination. In seeds of some *Inga* species there is no such mechanism, and *Inga* is one of the genera where the testa may be absent. The amount of radicle that is visible when viewed externally varies from concealed to completely visible, though in most genera only the tip of the radicle is visible. These cotyledonary characters often have diagnostic value.

Embryonic Axis

The embryonic axis may be straight (55), straight to slightly deflexed (7), or slightly deflexed (2). The length of the embryonic axis usually is parallel to the length or the longest axis of the seed (57), at right angles to the seed length (5), or in *Adenanthera* and *Monoschisma* at right or acute angle to the hilum. Most of these characters are illustrated in figure 4.

This study documents that 90 percent of the mimosoid genera have a straight embryonic axis. The slight deflection manifested in the remaining genera is a minor deviation and not similar to the sharp deflection commonly found in seeds of the Faboideae (fig. 4). Statements that the mimosoid radicle is usually short and thick are confirmed.

Plumule

The plumule is categorized as well developed (25), moderately developed (16), and rudimentary (20). One genus has well-developed to moderately developed plumules and two have well-developed to rudimentary plumules. These characters are illustrated in figure 4. The plumule of three genera of the Ingeae—Genus D, *Inga*, and *Zygia*—is distinctly pubescent. Lima (*1982*) in excellent drawings provided plumule details of South American taxa of the tribe Mimoseae.

Data about legume plumules are not readily available. Based on my study of mimosoid genera, plumule development is a useful character in seed identification and relates to phylogeny. Of the 22 genera in the advanced tribe Ingeae, 19 have well-developed plumules, *Archidendropsis* and *Cedrelinga* and some species of *Inga* have rudimentary plumules, and *Abarema* has a moderately developed plumule.

Fruit and Seed Key to Genera of Subfamily Mimosoideae[1]

1. Fruit indehiscent (remaining intact or breaking apart in intact segments).
   2. Fruit or 1 fruit layer separating into 1-seeded segments.
      3. Segments at time of separation composed only of endocarp.
         4. Segments not winged, ligneous ----------*Prosopis*, 3.15
         4. Segments winged, coriaceous.
            5. Segments falling from replum ----------*Pseudoentada*, 3.22
            5. Segments not falling from replum.
               6. Mesocarp absent ----------*Entada*, 3.13
               6. Mesocarp present, solid or fibrous.
                  7. Mesocarp solid ----------*Plathymenia*, 3.14
                  7. Mesocarp fibrous----------*Wallaceodendron*, 5.12
      3. Segments at time of separation composed of epicarp, mesocarp (if present), and endocarp.
         8. Segments breaking from sutures, falling from replum.
            9. Epicarp pubescent, prickly, or glandular ----------*Mimosa*, 3.27
            9. Epicarp glabrous ----------*Acacia*, 4.02
               Mimosa, 3.27
         8. Segments breaking across sutures, falling with attached suture segments.
            10. Seed transverse within segment ----------*Albizia*, 5.04
            10. Seed oblique to longitudinal within segment.
               11. Seed oblique ----------*Prosopidastrum*, 3.17
               11. Seed longitudinal ----------*Piptadeniopsis*, 3.18
   2. Fruit remaining entire, not separating into 1-seeded segments.
      12. Aril present ----------*Acacia*, 4.02
      12. Aril not present.
         13. Testa not adhering to embryo----------*Affonsea*, 5.01
            Inga, 5.02
            Parkia, 1.02
         13. Testa adhering to embryo.
            14. Pleurogram absent.
               15. Lens not discernible.
                  16. Endosperm present ----------*Dinizia*, 3.01
                  16. Endosperm absent.
                     17. Funiculus triangular ----------*Affonsea*, 5.01
                     17. Funiculus not triangular ----------*Entada*, 3.13
               15. Lens discernible.
                  18. Mesocarp present.
                     19. Mesocarp fibrous but not mealy----------*Inga*, 5.02
                     19. Mesocarp mealy and fibrous----------*Zygia*, 5.16
                  18. Mesocarp absent.
                     20. Fruit less than 5 cm long ----------*Mimozyganthus*, 2.01
                     20. Fruit more than 7 cm long.
                        21. Fruit less than 25 cm long ----------*Aubrevillea*, 3.02
                        21. Fruit more than 40 cm long ----------*Cedrelinga*, 5.18
            14. Pleurogram present.
               22. Lens not discernible.
                  23. Cotyledons auriculate over radicle.
                     24. Funiculus less than 3 mm long ----------*Dichrostachys*, 3.34
                     24. Funiculus over 4 mm long ----------*Prosopis*, 3.15

[1]Seed characters are used only when fruit characters have been exhausted.

23. Cotyledons split over radicle.
25. Plumule well developed ----------*Parkia*, 1.02
25. Plumule rudimentary ----------*Stryphnodendron*, 3.19
22. Lens discernible.
26. Fruit winged.
27. Fruit cruciform in transection ----------*Tetrapleura*, 3.09
27. Fruit compressed in transection.
28. Fruit 1-seeded----------*Xerocladia*, 3.16
28. Fruit multiseeded----------*Gagnebina*, 3.35
26. Fruit not winged.
29. Plumule rudimentary.
30. Mesocarp spongy to fibrous----------*Prosopis*, 3.15
30. Mesocarp absent----------*Schleinitzia*, 3.33
29. Plumule moderately to well developed.
31. Cotyledons auriculate or notched over radicle -------*Acacia*, 4.02
Dichrostachys, 3.34
Entada, 3.13
31. Cotyledons split over radicle.
32. Lens 1 mm long or longer ----------*Albizia*, 5.04
32. Lens less than 1 mm long or not discernible.
33. Fruit quadrangular to terete in transection.
34. Mesocarp spongy and partially filling cavity -------
----------*Amblygonocarpus*, 3.10
34. Mesocarp fibrous or absent ----------*Entada*, 3.13
Havardia, 5.09
33. Fruit compressed to flattened in transection.
35. Fruit bearing bristles or prickles or margin fringed --
----------*Mimosa*, 3.27
35. Fruit unarmed.
36. Seed without pleurogram ----------*Entada*, 3.13
36. Seed with pleurogram.
37. Mesocarp fibrous or spongy to hard.
38. Mesocarp spongy to hard but not fibrous ---
----------*Enterolobium*, 5.06
38. Mesocarp fibrous----------*Entada*, 3.13
Faidherbia, 4.01
Serianthes, 5.11
37. Mesocarp absent.
39. Funiculus filiform.
40. Endosperm present ----------*Acacia*, 4.02
Mimosa, 3.27
40. Endosperm absent----------*Entada*, 3.13
39. Funiculus thick.
41. Cotyledons with basally groined split over radicle ----------*Havardia*, 5.09
41. Cotyledons with simple split over radicle --
----------*Paraserianthes*, 5.10

1. Fruit dehiscent.
  42. Valves dehiscing by EITHER breaking from replum (if breaking as indehiscent segments from replum, see Fruit indehiscent) OR gaping along sutures before dehiscence.
    43. Valves gaping ----------*Schleinitzia,* 3.33
    43. Valves separating from replum.
      44. Endocarp nonseptate----------*Mimosa,* 3.27
      44. Endocarp septate or subseptate.
        45. Septa not transverse----------*Lysiloma,* 5.05
        45. Septa transverse.
          46. Fruit usually armed, apex beaked----------*Schrankia,* 3.28
          46. Fruit not armed, apex not beaked ----------*Prosopidastrum,* 3.17
  42. Valves dehiscing by opening apically, medially, or basally.
    47. Aril present.
      48. Aril orange to red (drying black) or yellow to white----------*Acacia,* 4.02
      48. Aril reddish brown, black, or white----------*Pithecellobium,* 5.08
    47. Aril absent.
      49. Fruit dehiscing by 1 margin.
        50. Fruit dehiscing by dorsal suture.
          51. Fruit coiled ----------*Acacia,* 4.02
                Archidendron, 5.15
          51. Fruit straight to semicircular.
            52. Endocarp septate ----------*Acacia,* 4.02
                Stryphnodendron, 3.19
            52. Endocarp subseptate to nonseptate.
              53. Endocarp ocher and streaked with purple or black -----*Acacia,* 4.02
              53. Endocarp monochrome.
                54. Endocarp tan to ocher.
                  55. Endocarp subseptate (composed of hairs) or fruit 1-seeded----------*Neptunia,* 3.37
                  55. Endocarp subseptate (not composed of hairs) to nonseptate.
                    56. Seed transverse ----------*Acacia,* 4.02
                        Genus D, 5.20
                    56. Seed oblique to longitudinal ----------*Acacia,* 4.02
                        Desmanthus, 3.36
                54. Endocarp orange, red, brown, gray, or white.
                  57. Mesocarp absent ----------*Archidendron,* 5.15
                  57. Mesocarp subligneous ----------*Goldmania,* 3.20
        50. Fruit dehiscing by ventral suture.
          58. Seeds winged.
            59. Margins (at least ventral) constricted between seeds ---------- ---------- *Monoschisma,* 3.25
            59. Margins not constricted.
              60. Mesocarp absent.
                61. Endocarp reticulate----------*Piptadeniastrum,* 3.07
                61. Endocarp not reticulate ----------*Newtonia,* 3.06
              60. Mesocarp fibrous to solid.
                62. Stipe absent----------*Cylicodiscus,* 3.04
                62. Stipe up to 20 mm long----------*Newtonia* (American), 3.23

58. Seeds not winged though winglike rim up to 2 mm wide may be present.
63. Mesocarp present.
64. Mesocarp poorly developed ----------*Albizia*, 5.04
64. Mesocarp well developed.
65. Mesocarp solid----------*Anadenanthera*, 3.26
65. Mesocarp spongy to fibrous ----------*Acacia*, 4.02
63. Mesocarp absent.
66. Ventral margin bearing 2 distinct lips absent from dorsal margin ----------*Punjuba*, unassigned Ingeae genus
66. Ventral and dorsal margins similar.
67. Fruit dehiscing medially.
68. Endocarp rugose ----------*Archidendron*, 5.15
68. Endocarp not rugose.
69. Endocarp dull and sometimes streaked with purple to black ----------*Acacia*, 4.02
69. Endocarp glossy, not streaked----------*Cojoba*, 5.17
67. Fruit dehiscing apically.
70. Seeds less than 15 per fruit ----------*Piptadenia*, 3.21
70. Seeds usually 15 or more per fruit----------*Parkia*, 1.02
49. Fruit dehiscing by both margins.
71. Mesocarp present.
72. Mesocarp spongy.
73. Valves elastically recurved to revolute----------*Calliandra*, 5.07
73. Valves passively opening.
74. Endocarp glossy----------*Adenanthera*, 3.08
74. Endocarp dull----------*Acacia*, 4.02
72. Mesocarp fibrous.
75. Seeds longitudinal ----------*Acacia*, 4.02
75. Seeds transverse to oblique.
76. Seeds oblique.
77. Epicarp reticulate----------*Acacia*, 4.02
77. Epicarp longitudinally or obliquely striate.
78. Fruit dolabriform ----------*Calpocalyx*, 3.30
78. Fruit other than dolabriform.
79. Fruit stipitate, stipe up to 20 mm long -----*Pentaclethra*, 1.01
79. Fruit substipitate.
80. Fruit less than 2.5 cm wide----------*Pseudoprosopis*, 3.11
80. Fruit more than 2.5 cm wide ----------*Xylia*, 3.31
76. Seeds transverse.
81. Epicarp shagreen ----------*Xylia*, 3.31
81. Epicarp reticulate.
82. Fruit linear ----------*Abarema*, 5.03
82. Fruit oblong ----------*Klugiodendron*, 5.19
71. Mesocarp absent.
83. Seeds winged.
84. Seeds longitudinal ----------*Indopiptadenia*, 3.05
84. Seeds transverse.
85. Fruit less than 17 cm long ----------*Parapiptadenia*, 3.24
85. Fruit 20 cm or more long----------*Fillaeopsis*, 3.03

83. Seeds not winged.
  86. Valves EITHER entire and falling from replum OR breaking into segments.
    87. Valves falling from replum ----------*Elephantorrhiza*, 3.12
    87. Valves breaking into segments----------*Schranckiastrum*, 3.29
  86. Valves neither falling from replum nor breaking into segments.
    88. Valves dehiscing elastically and recurving to revolute--------
    ----------*Calliandra*, 5.07
    88. Valves dehiscing passively.
      89. Endocarp septate to subseptate.
        90. Epicarp reticulate.
          91. Reticulation tending to anastomose near midvalve ----
          ----------*Paraserianthes*, 5.10
          91. Reticulation extending from margin to margin.
            92. Endocarp rugose ----------*Archidendron*, 5.15
            92. Endocarp not rugose.
              93. Fruit not moniliform.
                94. Cotyledons concealing margins of radicle -----
                ----------*Desmanthus*, 3.36
                94. Cotyledons concealing radicle or all but tip of radicle ----------*Acacia*, 4.02
              93. Fruit moniliform.
                95. Seed without pleurogram ----------*Cojoba*, 5.17
                95. Seed with pleurogram.
                  96. Cotyledons concealing margins of radicle ---
                  ----------*Leucaena*, 3.32
                  96. Cotyledons concealing all but tip of radicle.
                    97. Plumule rudimentary ----------*Gagnebina*, 3.35
                    97. Plumule well developed----------*Acacia*, 4.02
        90. Epicarp not reticulate.
          98. Valves opening basally ----------*Havardia*, 5.09
          98. Valves opening apically.
            99. Stipe oblique----------*Neptunia*, 3.37
            99. Stipe straight ----------*Piptadenia*, 3.21
      89. Endocarp nonseptate.
        100. Fruit nonstipitate ----------*Acacia*, 4.02
        Dichrostachys, 3.34
        Pararchidendron, 5.14

100. Fruit substipitate to stipitate.
  101. Seed without pleurogram.
    102. Seeds overlapping in fruit----------Genus D, 5.20
    102. Seeds not overlapping in fruit.
      103. Cotyledons notched, radicle exposed.
        104. Funiculus thick ----------*Piptadenia*, 3.21
        104. Funiculus filiform.
          105. Seed more than 20 mm long ----------
          ----------*Archidendropsis*, 5.13
          105. Seed less than 20 mm long ----------
          ---------- *Pithecellobium incuriale*,
          unassigned Ingeae species
      103. Cotyledons concealing radicle or all but tip of radicle.
        106. Fruit moniliform ----------*Archidendron*, 5.15
        106. Fruit not moniliform----------*Piptadenia*, 3.21
  101. Seed with pleurogram.
    107. Cotyledons concealing only margins of radicle.
      108. Fruit less than 1 cm wide ----------*Desmanthus*, 3.36
      108. Fruit 1 cm or more wide ----------*Leucaena*, 3.32
    107. Cotyledons concealing radicle or all but tip of radicle.
      109. Cotyledons concealing all but tip of radicle.
        110. Plumule rudimentary ----------*Piptadenia*, 3.21
        110. Plumule well developed----------*Acacia*, 4.02
      109. Cotyledons concealing radicle.
        111. Testa bright red or red and black--*Adenanthera*, 3.08
        111. Testa brown to black.
          112. Stipe over 20 mm long ----------*Parkia*, 1.02
          112. Stipe up to 10 mm long.
            113. Fruit dehiscing along both sutures and valves not recurving----------*Havardia*, 5.09
            113. Fruit dehiscing along dorsal suture and valves recurving --------*Pararchidendron*, 5.14

Seed Key to Three Subfamilies of Fabaceae

1. Hilum split longitudinally except for flattened seeds; pleurogram absent; embryonic axis usually deflexed so that radicle is nearly parallel to cotyledons or radicle once coiled; radicle not concealed by cotyledons----------Faboideae
1. Hilum without longitudinal split; pleurogram present or absent; embryonic axis usually straight, rarely deflexed, thus radicle rarely parallel to cotyledons; radicle either concealed or exposed.
   2. Pleurogram usually present; radicle straight or at most slightly deflexed and tip not near cotyledons, either concealed or partially concealed by cotyledons or cotyledons notched and radicle exposed ----------Mimosoideae
   2. Pleurogram usually absent; radicle straight to deflexed and not concealed by cotyledons ----------Caesalpinioideae

Seed Key to Genera of Subfamily Mimosoideae

1. Testa remaining with fruit, not with embryo ----------*Affonsea,* 5.01
Inga, 5.02
Parkia, 1.02

1. Testa remaining with embryo, not fruit.
2. Seed arillate.
3. Aril orange to red (drying black) to yellow or white ----------*Acacia,* 4.02
3. Aril reddish brown to black or white----------*Pithecellobium,* 5.08
2. Seed nonarillate.
4. Pleurogram present.
5. Radicle concealed by cotyledons.
6. Lens discernible.
7. Testa monochrome bright red or dichrome bright red and black---
----------*Adenanthera,* 3.08
7. Testa neither bright red nor bright red and black.
8. Cotyledons with simple split over radicle --------*Pithecellobium,* 5.08
8. Cotyledons with basally groined split over radicle.
9. Endosperm thin, adnate to testa ----------*Havardia,* 5.09
9. Endosperm absent.
10. Hilum exposed----------*Entada,* 3.13
10. Hilum concealed by funiculus or funicular remnant-------
----------*Enterolobium,* 5.06
6. Lens not discernible.
11. Testa pitted.
12. Pits restricted to areola ----------*Pararchidendron,* 5.14
12. Pits scattered over surface----------*Elephantorrhiza,* 3.12
11. Testa not pitted.
13. Seed 8 mm or less long----------*Abarema,* 5.03
13. Seed 10 mm or more long ----------*Parkia,* 1.02
5. Radicle not concealed by cotyledons (at least tip visible).
14. Radicle length (but not width) exposed.
15. Endosperm absent.
16. Cotyledons auriculate, radicle margins concealed-----*Xerocladia,* 3.16
16. Cotyledons notched over radicle.
17. Lens mound ----------*Entada,* 3.13
17. Lens flush----------*Anadenanthera,* 3.26
15. Endosperm present.
18. Seed less than 0.5 mm thick----------*Desmanthus,* 3.36
18. Seed 1 mm or more thick.
19. Seed 2 mm or less thick ----------*Leucaena,* 3.32
19. Seed 2.5 mm or more thick ----------*Prosopis,* 3.15
14. Radicle length partially (at least ½) or nearly concealed.
20. Endosperm absent.
21. Plumule rudimentary----------*Pseudoprosopis,* 3.11
21. Plumule moderately to well developed.
22. Cotyledons with simple split over radicle.
23. Lens 1 mm or more long----------*Albizia,* 5.04
23. Lens neither discernible nor less than 1 mm long.
24. Hilum recessed----------*Wallaceodendron,* 5.12

24. Hilum flush.
25. Seed less than 15 mm long----------*Calliandra,* 5.07
25. Seed 16 mm or more long ----------*Serianthes,* 5.11
22. Cotyledons with basally groined split over radicle.
26. Lens 1 mm or more long.
27. Radicle bulbous ----------*Acacia,* 4.02
27. Radicle oblong----------*Albizia,* 5.04
26. Lens less than 1 mm long.
28. Fracture lines absent.
29. Lens mound in depression----------*Lysiloma,* 5.05
29. Lens mound but not in depression----------*Entada,* 3.13
28. Fracture lines present.
30. Radicle bulbous ----------*Acacia,* 4.02
30. Radicle oblong ----------*Xylia,* 3.31
20. Endosperm present.
31. Plumule rudimentary.
32. Hilum concealed by funicular remnant.
33. Lens not discernible----------*Stryphnodendron,* 3.19
33. Lens discernible.
34. Testa white to tan ----------*Goldmania,* 3.20
34. Testa greenish brown ----------*Gagnebina,* 3.35
32. Hilum exposed.
35. Pleurogram 100 percent----------*Plathymenia,* 3.14
35. Pleurogram 75-50 percent.
36. Pleurogram 50 percent----------*Prosopidastrum,* 3.17
36. Pleurogram 75 percent.
37. Lens flush or nearly so ----------*Piptadenia,* 3.21
37. Lens mound.
38. Lens blackish mound within hilar depresion -------
----------*Neptunia,* 3.37
38. Lens tan mound, hilar depression absent ----------
----------*Schleinitzia,* 3.33
31. Plumule moderately to well developed.
39. Cotyledons auriculate over radicle----------*Acacia,* 4.02
Dichrostachys, 3.34
Pseudoentada, 3.22
39. Cotyledons split over radicle.
40. Seed with 2 (rarely 1) longitudinal grooves on each face.
41. Lens tan, testa dark brown ----------*Schranckiastrum,* 3.29
41. Lens color of testa (blackish brown to brown) ---*Schrankia,* 3.28
40. Seed without grooves.
42. Cotyledon with basally groined split.
43. Lens 1 mm or more long----------*Albizia,* 5.04
43. Lens less than 1 mm long or not discernible.
44. Lens not discernible----------*Dichrostachys,* 3.34
44. Lens discernible.
45. Lens linear ----------*Lysiloma,* 5.05
45. Lens other than linear ----------*Mimosa,* 3.27
42. Cotyledon with simple split.

46. Endosperm encasing embryo.
47. Lens linear----------*Amblygonocarpus*, 3.10
47. Lens ellipsoid to oblong ----------*Tetrapleura*, 3.09
46. Endosperm adnate to testa.
48. Endosperm thick----------*Paraserianthes*, 5.10
48. Endosperm thin or scanty.
49. Lens groove ----------*Faidherbia*, 4.01
49. Lens mound ----------*Calliandra*, 5.07

4. Pleurogram absent.
50. Wing or winglike rim present.
51. Embryonic axis at right angles to seed length.
52. Winglike rim present----------*Anadenanthera*, 3.26
Archidendropsis, 5.13
52. Wing present.
53. Embryonic axis slightly deflexed ----------*Piptadeniastrum*, 3.07
53. Embryonic axis straight.
54. Seed more than 50 mm long ----------*Fillaeopsis*, 3.03
54. Seed less than 30 mm long.
55. Cotyledon bases cordate----------*Parapiptadenia*, 3.24
55. Cotyledon bases rounded ----------*Indopiptadenia*, 3.05
51. Embryonic axis parallel to seed length.
56. Seeds more than 50 mm long.
57. Plumule rudimentary----------*Cylicodiscus*, 3.04
57. Plumule moderately developed ----------*Newtonia*, 3.06
56. Seeds less than 30 mm long.
58. Tip of radicle within cotyledon margins----*Newtonia* (American), 3.23
58. Tip of radicle exceeding cotyledon margins.
59. Seed oblong ----------*Newtonia*, 3.06
59. Seed subcircular to short elliptic----------*Monoschisma*, 3.25
50. Wing or winglike rim absent.
60. Endosperm present.
61. Radicle tip or more exposed ----------*Dinizia*, 3.01
61. Radicle concealed by cotyledons.
62. Seed 9 mm or more long ----------*Elephantorrhiza*, 3.12
62. Seed not exceeding 8 mm----------*Abarema*, 5.03
60. Endosperm absent.
63. Lens not discernible.
64. Cotyledons notched exposing radicle.
65. Testa chartaceous----------*Pithecellobium incuriale*,
unassigned Ingeae species

65. Testa coriaceous to osseous ----------*Entada,* 3.13
64. Cotyledons concealing radicle.
66. Cotyledons with basally groined split or auriculate over radicle.
67. Seed with 1 curved and 1 straight margin--------*Calpocalyx,* 3.30
67. Seed with 1 curved and 1 subangular margin -- *Pentaclethra,* 1.01
66. Cotyledons with simple split or entire.
68. Plumule densely pubescent ----------Genus D, 5.20
68. Plumule glabrous.
69. Testa chartaceous.
70. Hilum punctiform ----------*Archidendron,* 5.15
Klugiodendron, 5.19
70. Hilum elliptic to triangular or circular ---*Archidendron,* 5.15
Punjuba, unassigned Ingeae genus
69. Testa coriaceous to osseous.
71. Testa shagreen ----------*Affonsea,* 5.01
71. Testa pitted and/or rugose or smooth.
72. Testa pitted and rugose----------*Cojoba,* 5.17
72. Testa not pitted though rugose or smooth ---*Abarema,* 5.03
Archidendron, 5.15
63. Lens discernible.
73. Plumule rudimentary.
74. Testa chartaceous.
75. Seed 25 mm or more long----------*Cedrelinga,* 5.18
75. Seed not exceeding 20 mm long ----------*Piptadenia,* 3.21
74. Testa coriaceous to osseous.
76. Radicle tip or more exposed ----------*Mimozyganthus,* 2.01
76. Radicle concealed----------*Inga,* 5.02
73. Plumule moderately or well developed.
77. Plumule pubescent.
78. Cotyledon faces concave----------*Zygia,* 5.16
78. Cotyledon faces flat----------*Inga,* 5.02
77. Plumule glabrous.
79. Radicle concealed----------*Aubrevillea,* 3.02
79. Radicle tip or entire radicle exposed.
80. Seed over 20 mm long ----------*Entada,* 3.13
80. Seed less than 10 mm long ----------*Piptadeniopsis,* 3.18

Parkieae (1.01-1.02)

Genus: *Pentaclethra* Bentham.

Phylogenetic Number: 1.01.

Tribe: Parkieae.

Species studied - Species in Genus: 1 sp. - 2 spp.

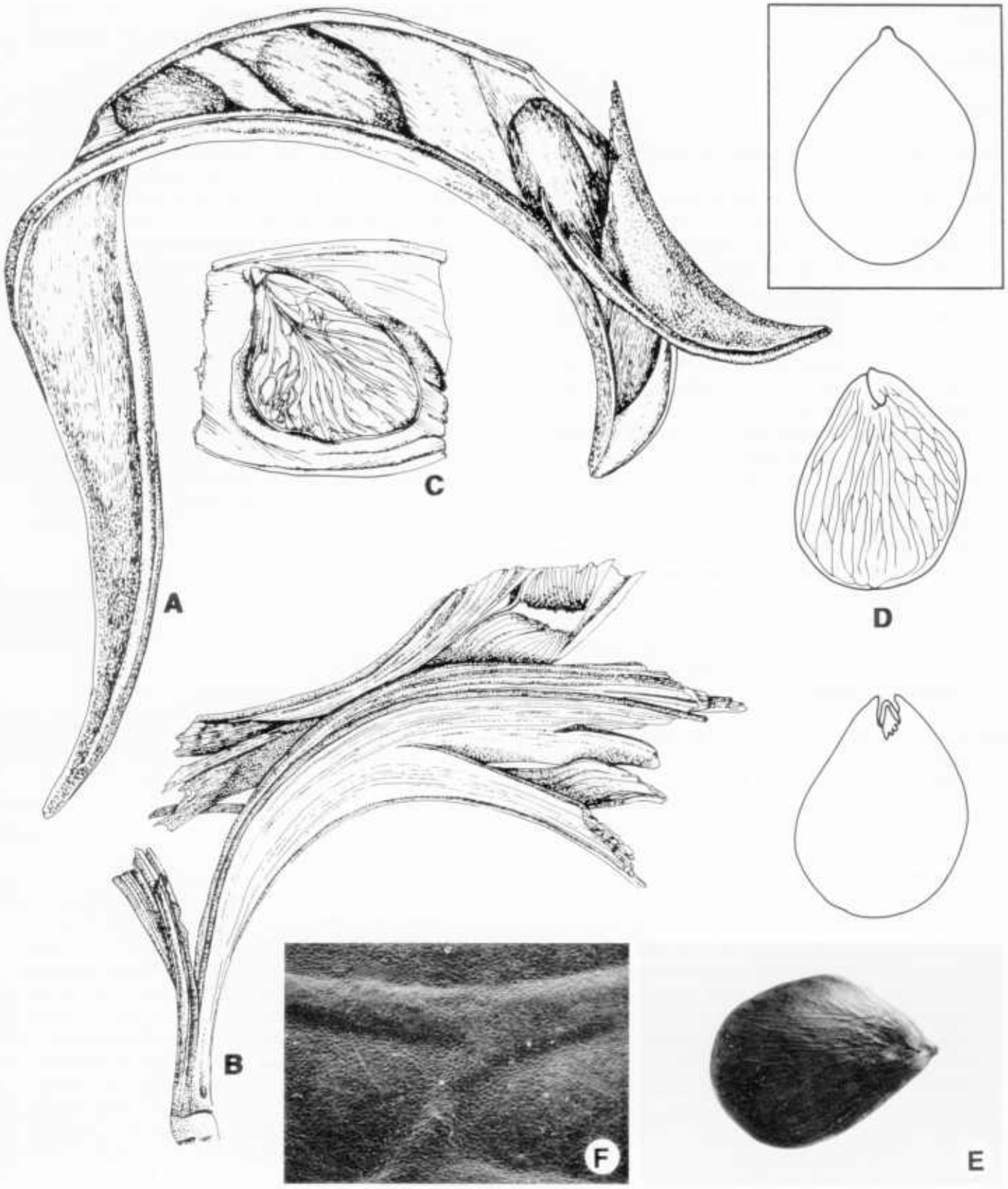
Fruit 30-74 × 2-10 × 1-3 cm, straight, without twists (curving, coiling, or twisting during dehiscence), oblong to broadly linear or linear, margins not constricted, short tapered to apex, long tapered to stipe up to 20 mm long, compressed, ligneous. Valves dehiscing apically along both sutures and elastically revolute and either forming 1-2 coils around large lumen or twisting or fracturing near or below middle, partially tearing away from one or both sutures (sutures often splitting during dehiscence), with or without visible seed chambers. Epicarp dull, dark brown, glabrous, longitudinally venose, partially exfoliating. Mesocarp fibrous, ligneous. Endocarp dull, reddish brown, with oblique cracks and partially separating from mesocarp during dehiscence, subseptate. Seeds 3-8, oblique, not overlapping, in 1 series. Funiculus 2-4 mm long, thick, triangular (3-5 mm wide at base).

Seed 25-90 × 20-55 × 5-15 mm, ovate to elliptic with one margin curved and other subangulate, compressed. Testa glossy to dull, brown, with or without fanlike reticulation, coriaceous to subosseous, without pleurogram or fracture lines or wing or aril. Hilum elliptic, up to 5 mm long, concealed by funicular remnant, raised and surrounded by dark-brown halo, apical. Lens not discernible. Endosperm absent. Cotyledons auriculate or with basally groined split over radical, concealing radicle, with to without fanlike reticulation. Embryonic axis straight. Plumule moderately developed.

Distribution: Central America, northern South America, and tropical Africa.

Notes: Elias (*1981*) reported that *Pentaclethra* and *Dimorphandra* Schott (Caesalpinieae, Caesalpinioideae) are remarkably similar and possibly more closely related to each other than to other genera in their respective tribes. Fruit and seed characters support neither this conclusion nor the relationship of *Pentaclethra* to *Parkia* R. Brown. Based on their characters *Pentaclethra* is unique, belonging in its own primitive tribe, and *Parkia* should be placed in the more advanced tribe Mimoseae.

Pentaclethra: P. macroloba (Willdenow) O. Kuntze (*A-F*). *A*, Valve with fragment of second valve (× 1); *B*, partial dehiscent fruit (× 0.5); *C*, seed in situ (× 1); *D*, cotyledon concealing radicle (upper) and embryonic axis (lower) (× 1); *E-F*, testa (× 1, × 50).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Genus: *Parkia* R. Brown.

Phylogenetic Number: 1.02.

Tribe: Parkieae.

Species Studied - Species in Genus: 16 spp. - ca. 40 spp.

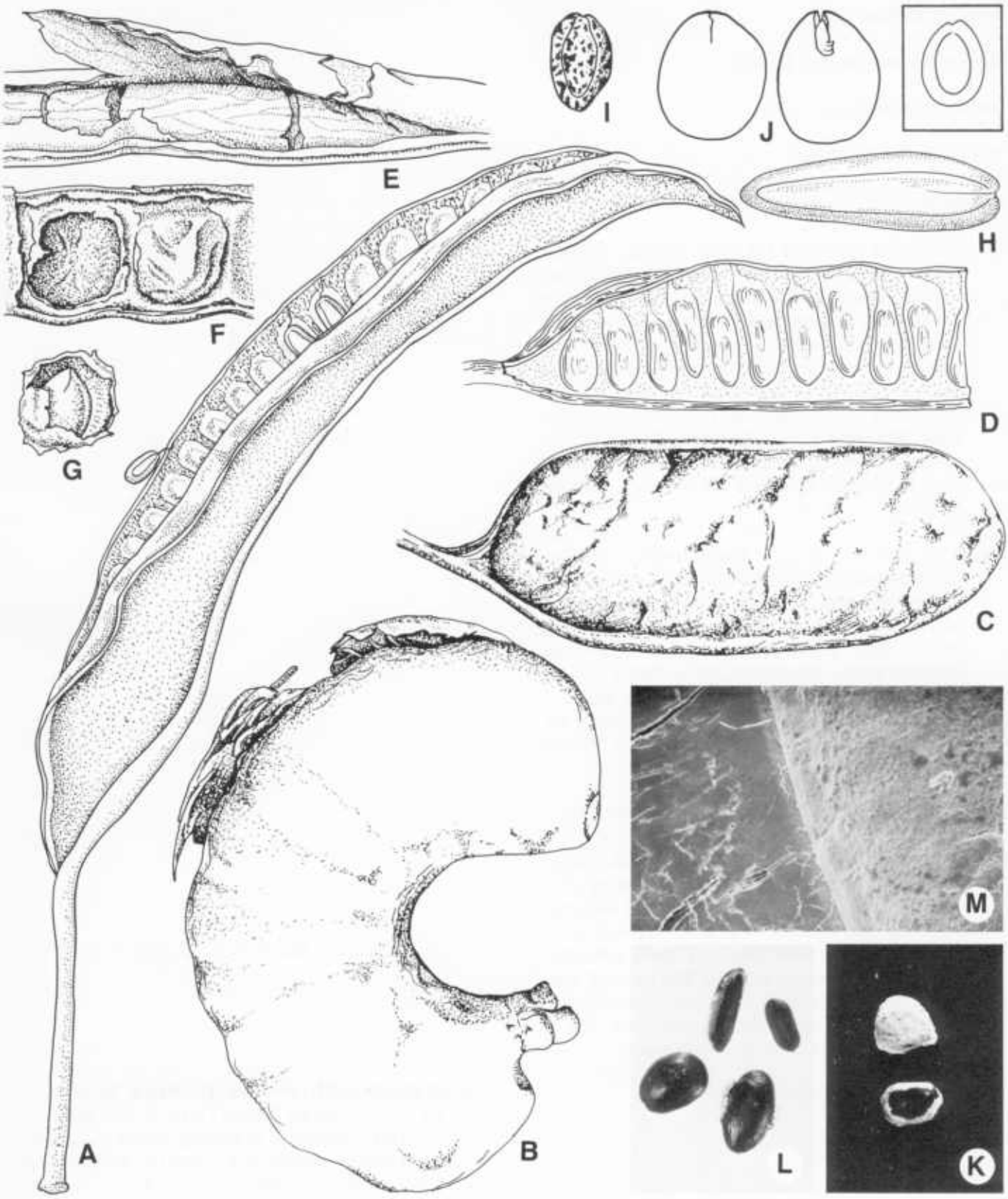
Fruit 8.5-60 × 1.5-9 × 0.2-2 cm, straight to ½-coiled, without or with twists, oblong to broadly linear, margins not constricted to slightly constricted, rounded to short tapered to apex, short tapered to stipe 10 to at least 100 mm long or substipitate, compressed to terete, fleshy when fresh becoming coriaceous to subligneous or tough-fleshy upon drying. Valves either dehiscing apically along ventral or both sutures or indehiscent, remaining attached to sutures, with or without visible seed chambers. Epicarp dull to glossy, brown to black or purple, glabrous to glabrate or velutinous (reddish-brown hairs), transverse reticulate to rugose, occasionally partially exfoliating. Mesocarp absent. Endocarp dull, brown to grayish ocher or bright yellow to white, either subseptate to septate or if layered and indehiscent then part of endocarp remaining with fruit is nonseptate. Seeds 10-34, transverse, not overlapping, in 1 or if 2 series with funiculus alternately longer and shorter. Funiculus 1.5-12 mm long, filiform to thick, S-curved to contorted or plicate.

Seed 6.5-60 × 3-14 × 2-13 mm, ovate to oblong or long-cuneate to elliptic, compressed but most with umbo centered in areola. Testa glossy, black to brown, monochrome to rarely mottled, smooth to cuticle exfoliating or occasionally bearing endocarp remnants, osseous, with 75-100 percent pleurogram (*P. oppositifolia* Spruce ex Bentham has both types), without fracture lines or wing or aril. Hilum punctiform to linear and 0.2 mm long in *P. multijuga*, exposed or concealed by funicular remnant, recessed and not occluded to somewhat occluded, subapical to rarely apical. Lens not discernible. Endosperm either thin and adnate to testa or absent. Cotyledons with simple or basally groined split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed.

Distribution: Tropical South America to Central America, Africa, and Asia to New Guinea and Fiji (Hopkins, pers. commun., 1982).

Notes: The inflated chartaceous testa of *P. bicolor* remains adnate to the endocarp and not the embryo. Its embryo may fall free of the testa and fruit. Hagos (*1962*) noted that in the African species *P. filicoidea* Welwitsch ex Oliver the noninflated testa was detached from the embryo. Hopkins (pers. commun., 1982) considered the texture of the endocarp to be an important character in this genus. The African and at best some Asian species have an endocarp consisting of a "dry farinaceous pulp" not found in mature neotropical *Parkia* fruits. The inner endocarp surface "of many neotropical species is smooth and white." She noted that a large quantity of amber-colored gum is produced on dehiscing by the adaxial suture of *P. pendula*. Similar gum also is present within indehiscent legumes of several other neotropical species, e.g., *P. decussata* Ducke, *P. nitida* Miquel, *P. panurensis* Bentham ex H. C. Hopkins, and *P. igneiflora* Ducke.

Parkia: P. bicolor A. Chevalier (*F-G*), *P. biglobosa* (Jacquin) R. Brown ex G. Don f. (*E, J*), *P. discolor* Spruce ex Bentham (*C, K, M*), *P. multijuga* Bentham (*B, H*), *P. pendula* (Willdenow) Bentham (*A, D, I*), *P.* spp. (*L*). *A*, Dehiscent fruit (× 1); *B*, fruit (× 0.5); *C*, fruit (× 1); *D*, part of endocarp (× 1); *E*, broken endocarp within epicarp (× 1); *F*, inflated testa in situ (× 1); *G*, embryo in situ (× 1); *H*, seed topography (× 1); *I*, seed topography (× 2); *J*, cotyledon concealing radicle (left) and embryonic axis (right) (× 2); *K*, endocarp layer encasing seed (× 1); *L-M*, testa (× 1, × 50).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Mimozygantheae (2.01)

Genus: *Mimozyganthus* Burkart.

Phylogenetic Number: 2.01.

Tribe: Mimozygantheae.

Species Studied - Species in Genus: 1 sp. - 1 sp.

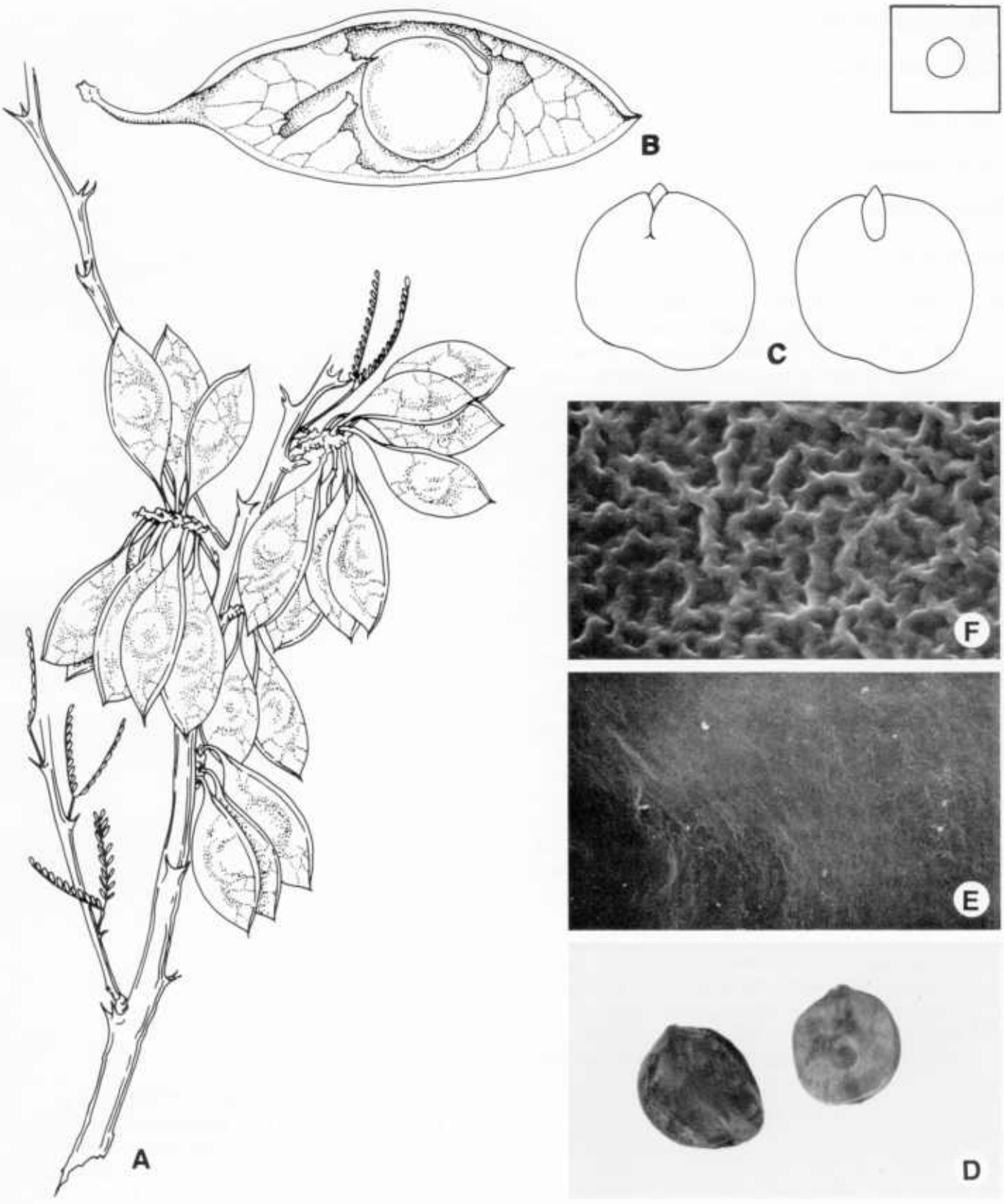
Fruit 2-3.5 × 0.8-1.5 × 0.1-0.2 cm, straight, without twists, elliptic to obovate, margins not constricted but ventral margin curved and wider than straighter dorsal margin, short tapered to rounded at apex, short tapered to stipe 3-6 mm long, flattened, coriaceous. Valves indehiscent, remaining attached to sutures, with visible single seed chamber. Epicarp dull, ocher to tan, glabrous, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, pale ocher, nonseptate. Seeds 1-2, oblique, not overlapping, in 1 series. Funiculus 5-6 mm long, filiform, S-curved.

Seed 5.2-7.3 × 5.4-7.5 × 1-1.8 mm, ovate to circular or subtrapeziform, flattened. Testa glossy, medium to dark brown or brownish gray, rugose, coriaceous, without pleurogram or fracture lines or wing or aril. Hilum punctiform, concealed by funicular remnant, flush, subapical. Lens up to 0.4 mm long, irregular, flush, ocher. Endosperm absent. Cotyledons auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule rudimentary.

Distribution: Argentina and western Paraguay.

Notes: Burkart (*1939*) monographed the genus. Placement of the monotypic genus *Dinizia* Ducke of Brazil and Guyana in this tribe has been discussed, evaluated, and rejected by Elias (*1981*), who did not cite fruit and seed characters. Fruit and seed characters support his decision. The short (5 mm or less in length) stipe is so clearly discernible that the fruits are not described as substipitate. The micropyle remains open in mature seeds.

Mimozyganthus: M. carinatus (Grisebach) Burkart (*A-F*). *A*, Fruiting branch (×1); *B*, seed in situ (× 3); *C*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 5); *D-F*, testa (× 3, × 50, × 1,000).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Mimoseae (3.01-3.37)

Genus: *Dinizia* Ducke.

Phylogenetic Number: 3.01.

Tribe: Mimoseae.

Group: Dinizia.

Species Studied - Species in Genus: 1 sp. - 1 sp.

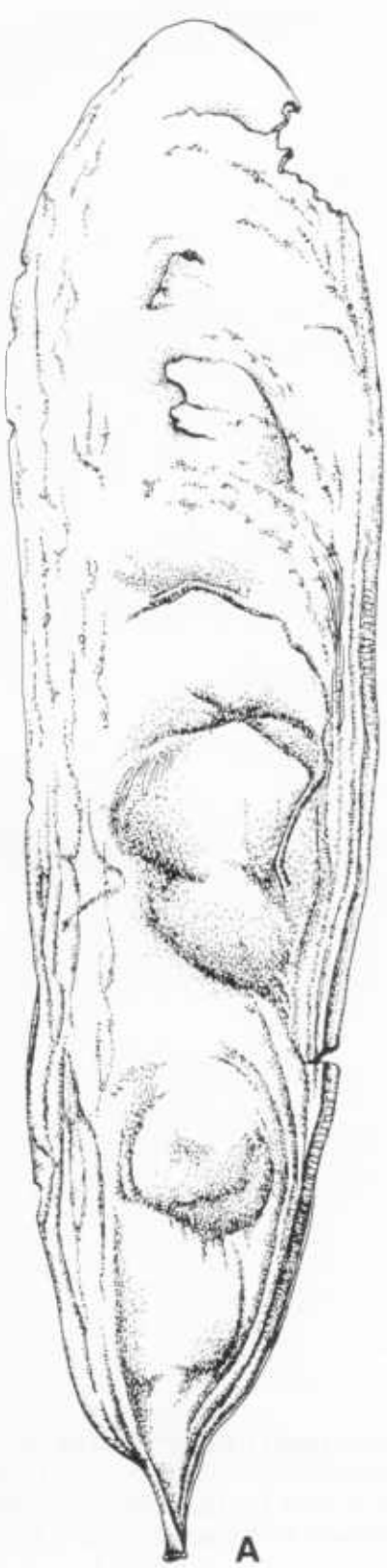
Fruit 15-35 × 5-7 × 0.1-0.5 cm, straight to slightly curved, without twists, broadly oblong, margins not constricted, short tapered to apex, tapered to rounded to stipe up to 25 mm long, flattened, coriaceous. Valves indehiscent, remaining attached to sutures, with faintly visible seed chambers. Epicarp glossy, brown to blackish brown, glabrous, faintly reticulate and with prominent series of longitudinal wrinkles paralleling both margins, not exfoliating. Mesocarp absent. Endocarp dull, tan, nonseptate though seed chambers fringed by spongy tissue. Seeds up to 10, transverse, not overlapping, in 1 series. Funiculus to 13 mm long, filiform, S-curved.

Seed 10-13 × 6-7 × 1.5 mm, oblong, compressed. Testa glossy, blackish, bearing faint parallel striations (testa splitting along striations during imbibition), chartaceous, without pleurogram or fracture lines or wing or aril. Hilum punctiform, concealed or not by funicular remnant, recessed, apical. Lens not discernible. Endosperm thick, encasing embryo and masking true position of radicle. Cotyledons auriculate over radicle, concealing only margins of radicle. Embryonic axis straight. Plumule rudimentary.

Distribution: Brazil and Guyana.

Notes: More seeds and fruits should be collected and distributed to herbaria, because mature seeds are seldom found in the collected fruits. Fruit and seed characters confirm the decision of Elias (*1981*) not to place this genus in the Mimozygantheae.

Dinizia: D. excelsa Ducke (*A-G*). *A*, Fruit (× 1); *B*, seed in situ (× 1); *C*, seed topography (× 2); *D*, endosperm (× 2); *E*, cotyledon concealing only margin of radicle (left) and embryonic axis (right) (× 2); *F-G*, testa (× 3, × 50).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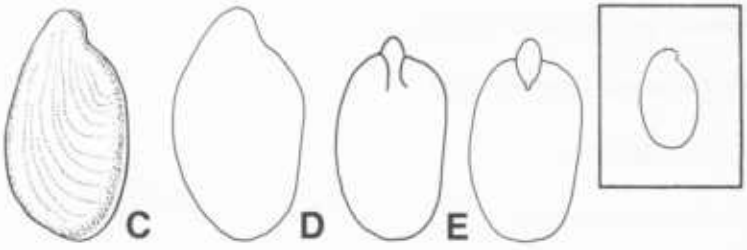
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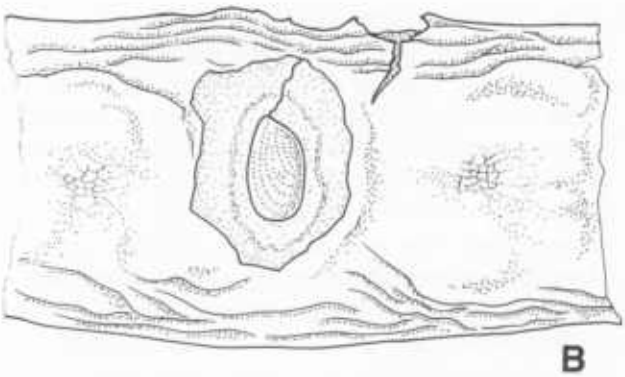
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Genus: *Aubrevillea* Pellegrin.

Phylogenetic Number: 3.02.

Tribe: Mimoseae.

Group: Aubrevillea.

Species Studied - Species in Genus: 2 spp. - 2 spp.

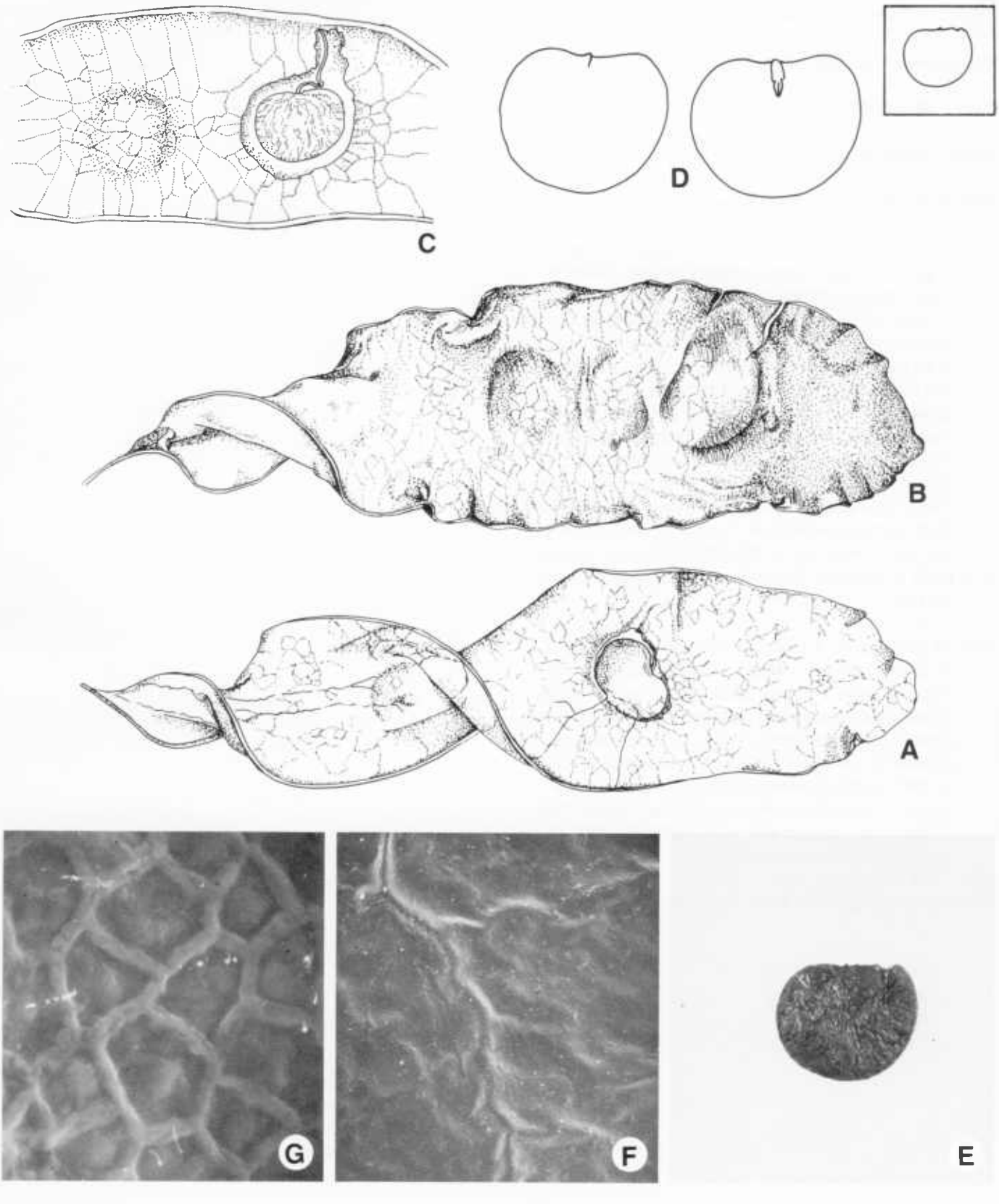
Fruit 9-22 × 2-5.5 × 0.1-0.4 cm, straight, with 1-2 twists near base and occasionally medial or apical twist, oblong, margins not constricted, short tapered to apex, short tapered to stipe up to 20 mm long or nonstipitate, flattened, chartaceous. Valves indehiscent, remaining attached to sutures, with visible seed chambers. Epicarp dull, ocher to tan except brown over seed chambers, glabrous, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, ocher to tan except brown seed chambers, reticulate, nonseptate. Seeds 1-7, parallel to transverse, not overlapping, in 1 series. Funiculus to 20 mm long, filiform, S-curved to contorted or plicate.

Seed 13-15 × 12-14 × 2 mm, reniform, flattened. Testa dull, brown, rugose with reticulate pattern, chartaceous, without pleurogram or fracture lines or wing or aril. Hilum punctiform, concealed by funicular remnant, flush, apical. Lens up to 5 mm long, irregular, flush, black, on same side of hilum as micropyle. Endosperm absent. Cotyledons with simple split over radicle, concealing radicle. Embryonic axis straight and at right angles to seed length. Plumule moderately developed.

Distribution: Guineo-Congo forests.

Notes: Seed of both species bear a well-developed tan raphe starting on side away from micropyle and lens and encircling margin of seed to about 5 mm from lens. The lens on the same side of hilum as the micropyle also is found in the Cercideae (Caesalpinioideae) but probably not in other genera or tribes of the Fabaceae. Fruits have been described as samaroid (Brenan, *1955*).

Aubrevillea: A. kerstingii (Harms) Pellegrin (*B-C*), *A. platycarpa* Pellegrin (*A, D-G*). *A, C,* Seeds in situ (× 1); *B,* fruit (× 1); *D,* cotyledon concealing radicle (left) and embryonic axis (right) (× 3); *E-G,* testa (× 2, × 50, × 1,000).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Genus: *Fillaeopsis* Harms.

Phylogenetic Number: 3.03.

Tribe: Mimoseae.

Group: Fillaeopsis.

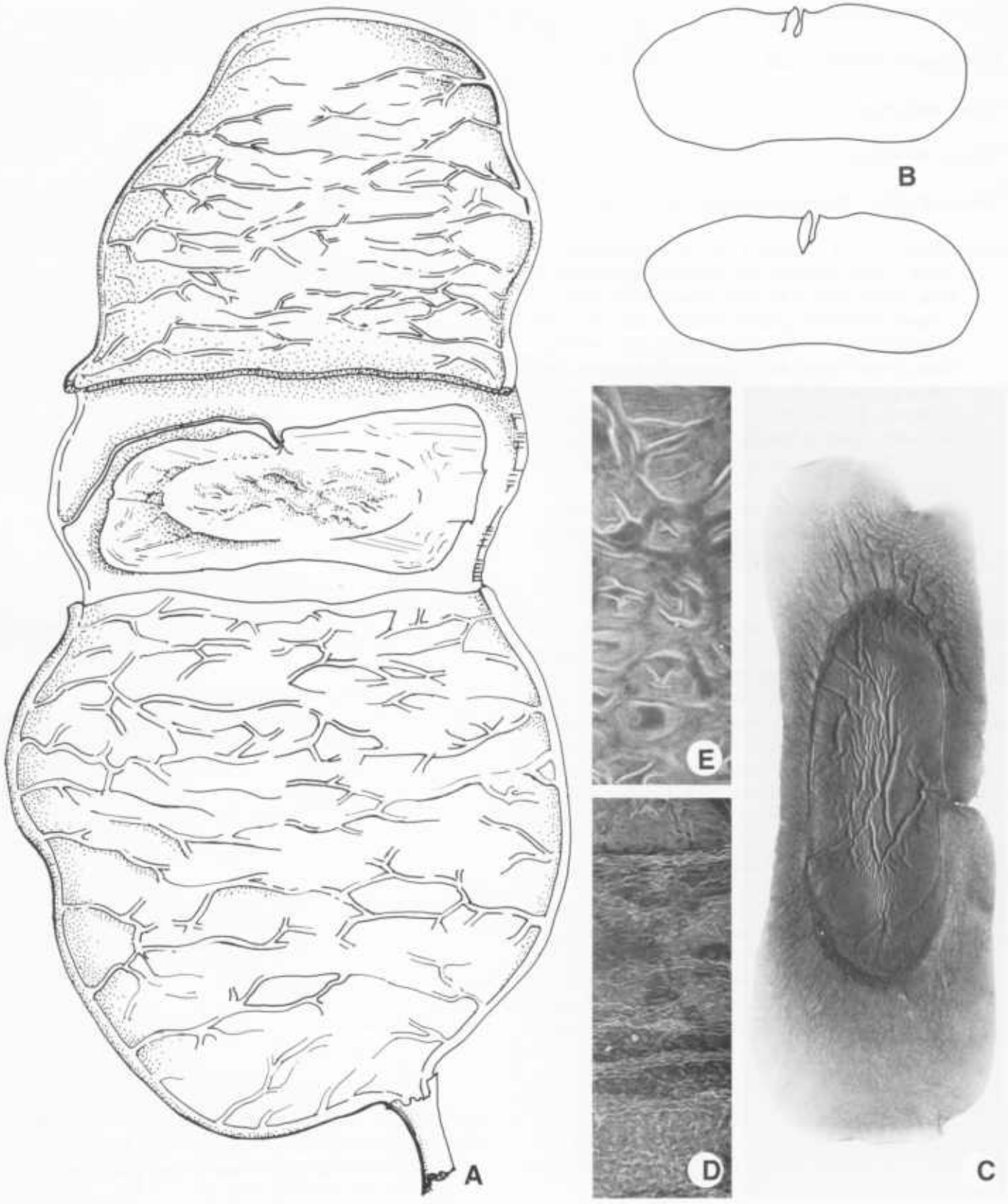
Species Studied - Species in Genus: 1 sp. - 1 sp.

Fruit 20-60 × 10-20 × 0.1-0.4 cm, straight to slightly curved, without twists, broadly oblong, margins constricted, rounded to apex, rounded to tapered to stipe up to 10 mm long or substipitate, flattened, subcoriaceous. Valves dehiscing medially along both sutures, remaining attached to sutures, without visible seed chambers. Epicarp glossy, brown, glabrous, transversely reticulate and inconspicuously transversed ribbed about 4 cm apart, partially exfoliating. Mesocarp absent. Endocarp dull, brown, transversely reticulate (fibrous below surface), nonseptate but with straw-colored transverse lines between seeds up to 3 cm long and about 4 cm apart. Seeds up to 10, transverse, not overlapping, in 1 series. Funiculus 6-7 mm long, filiform, curved.

Seed 70-130 × 25-35 × 0.01-0.03 mm, oblong, flattened. Testa dull, brown, rugose, chartaceous, with conspicuous wing 5-25 mm wide (widest at each end), without pleurogram or fracture lines or aril. Hilum punctiform, occluded by wing, flush, apical according to embryonic axis and marginal according to seed length. Lens not discernible. Endosperm absent. Cotyledons notched exposing radicle. Embryonic axis straight and right angles to seed length. Plumule rudimentary.

Distribution: Nigeria to Zaire and Angola.

Fillaeopsis: F. discophora Harms (*A-E*). *A,* Fruit with seed in situ (× 0.5); *B,* cotyledon not concealing radicle (upper) and embryonic axis (lower) (× 1); *C-E,* testa (× 1, × 50, × 1,000).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Genus: *Cylicodiscus* Harms.

Phylogenetic Number: 3.04.

Tribe: Mimoseae.

Group: Newtonia.

Species Studied - Species in Genus: 1 sp. - 1 sp.

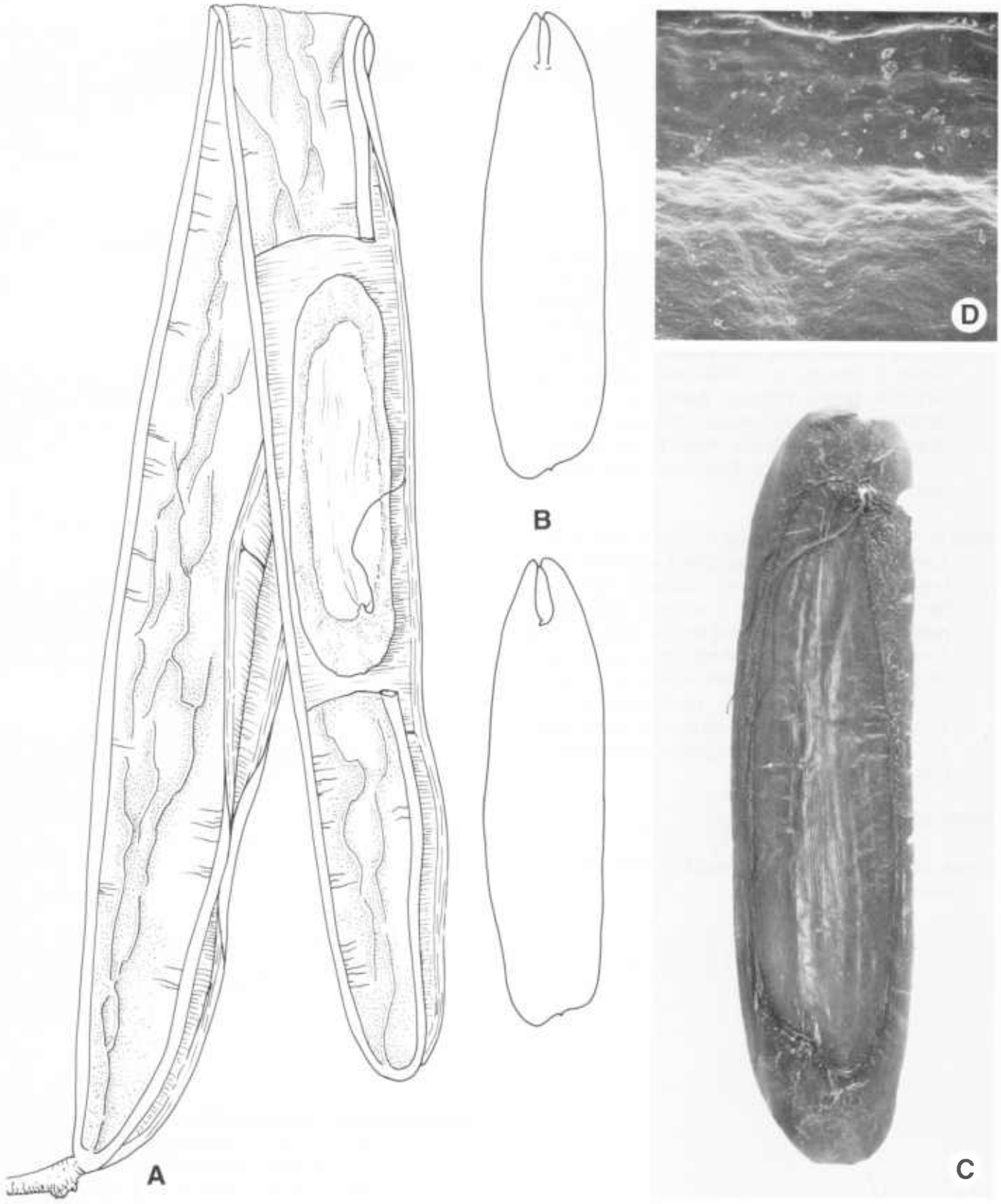
Fruit 60-75 × 3.5-4 × 0.2-0.3 cm, curved, without twists, linear, margins not constricted, rounded to apex, short tapered to base, nonstipitate, compressed, coriaceous. Valves dehiscing medially and reflexing along ventral suture eventually opening along dorsal suture and occasionally twisting, remaining attached to sutures, without visible seed chambers. Epicarp dull, brown, velutinous and this layer cracking and exfoliating during dehiscence exposing glabrous, glossy, faintly reticulate inner surface. Mesocarp fibrous, subligneous. Endocarp dull, brown, nonseptate. Seeds unknown number, parallel, overlapping, in 1 series. Funiculus ca. 50 mm long, filiform, S-curved.

Seed 100-110 × 24-30 × 1 mm, oblong, flattened. Testa glossy, brown, occasionally with patches of lighter brown, rugose, chartaceous, with wing up to 2 mm wide along margins and 20 mm wide at base, without pleurogram or fracture line or aril. Hilum punctiform, occluded by wing, flush, marginal. Lens not discernible. Endosperm absent. Cotyledons notched exposing radicle. Embryonic axis straight. Plumule rudimentary.

Distribution: Guineo-Congo forests.

Notes: Because of the size of the seed, there is no room in the illustration to depict a × 1 seed drawing in an upper right box. An entire seed is shown in *C* at × 1. There were not enough fruits available to open even one in order to count its seeds. More fruits should be collected and deposited in herbaria.

Cylicodiscus: C. gabunensis Harms (*A-D*). *A*, Dehiscent fruit with seed in situ (× 0.5); *B*, cotyledon not concealing radicle (upper) and embryonic axis (lower) (× 1); *C-D*, testa (× 1, × 50).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Genus: *Indopiptadenia* Brenan.

Phylogenetic Number: 3.05.

Tribe: Mimoseae.

Group: Newtonia.

Species Studied - Species in Genus: 1 sp. - 1 sp.

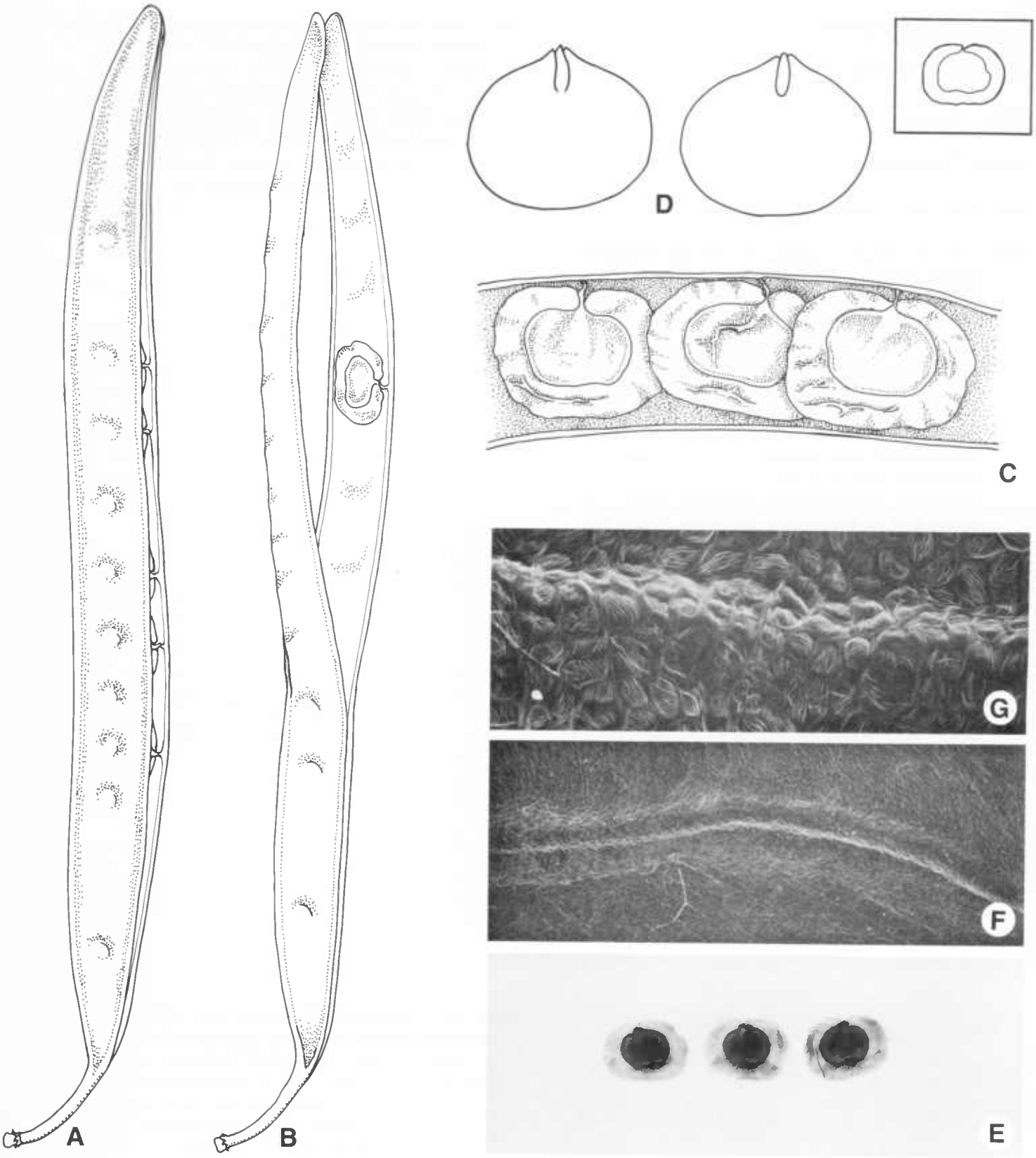
Fruit 21-23 × 1.3-1.5 × 0.1-0.2 cm, slightly curved to straight, without twists, linear, margins not constricted, rounded to apex, tapered to stipe up to 30 mm long, flattened, subcoriaceous. Valves dehiscing apically along both sutures, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown, glabrous, faintly reticulate, not exfoliating. Mesocarp absent. Endocarp dull, straw-colored, nonseptate. Seeds 11-16, parallel, overlapping, in 1 series. Funiculus 2 mm long, filiform, hooked.

Seed 16 × 12 × 1 mm, oblong to elliptic, flattened. Testa glossy, wing reddish brown and body dark brown, rugose, chartaceous, with wing best developed on each end and up to 4.5 mm wide, without pleurogram or fracture lines or aril. Hilum punctiform, occluded by wing, flush, apical according to embryonic axis and marginal according to seed length. Lens not discernible. Endosperm absent. Cotyledons notched exposing radicle. Embryonic axis straight and at right angles to seed length. Plumule rudimentary.

Distribution: India and Nepal.

Notes: More fruits and seeds should be collected and distributed to herbaria.

Indopiptadenia: I. oudhensis (Brandis) Brenan (*A-G*). *A-B*, Fruits (× 1); *C*, seed in situ (× 2); *D*, cotyledon not concealing radicle (left) and embryonic axis (right) (× 4); *E-G*, testa (× 1, × 50, × 1,000).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Genus: *Newtonia* Baillon s.s.

Phylogenetic Number: 3.06.

Tribe: Mimoseae.

Group: Newtonia.

Species Studied - Species in Genus: 6 spp. - 11 spp.

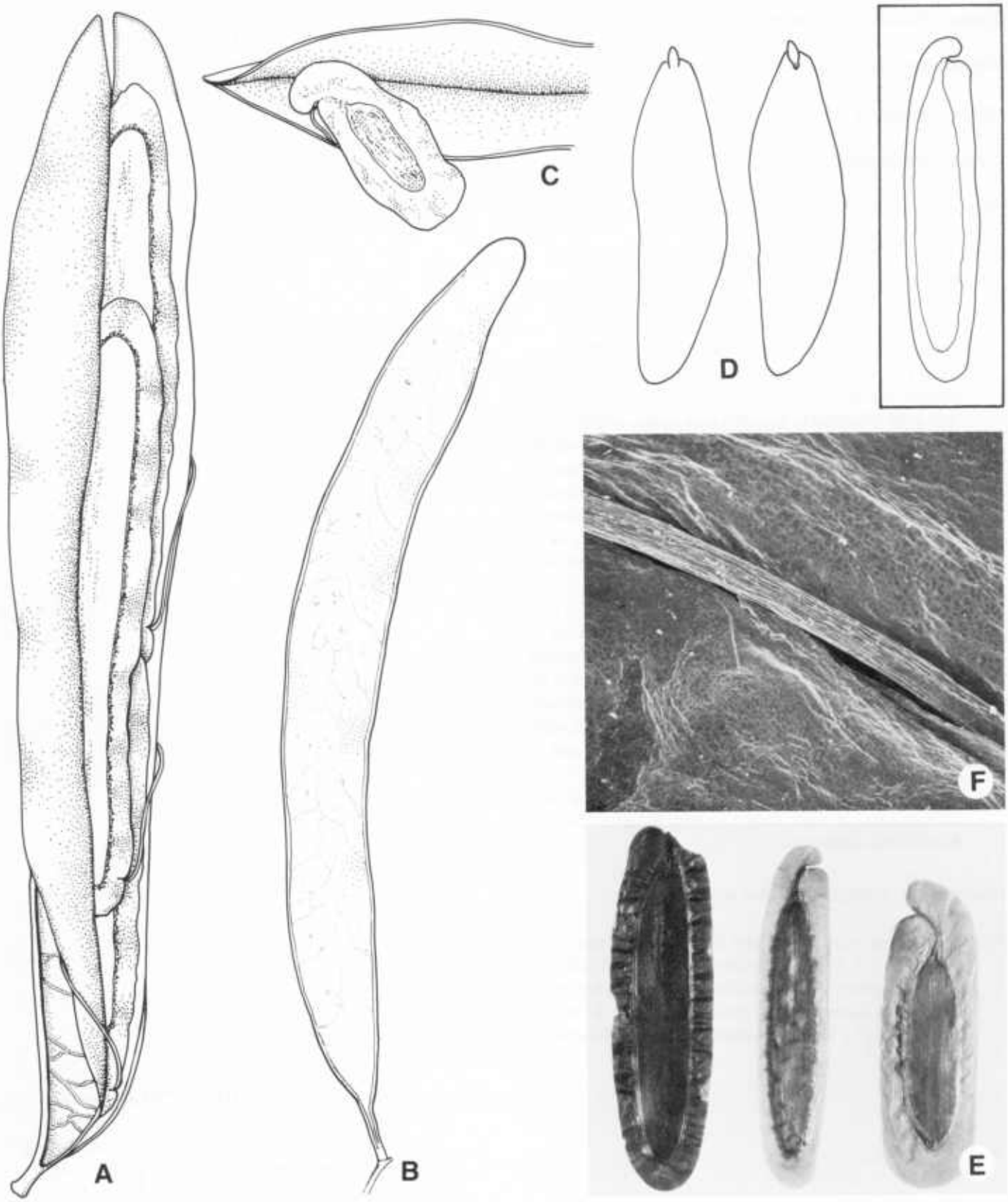
Fruit 8-60 × 1.3-3.5 × 0.2-0.3 cm, straight to slightly curved, with twists, broadly linear, margins not constricted, short tapered to apex, short tapered to stipe up to 10 mm long, compressed to flattened, coriaceous. Valves dehiscing medially along ventral suture and remaining united along dorsal suture, remaining attached to sutures, without visible seed chambers. Epicarp dull to glossy, light to dark brown or reddish brown or black, glabrous, parallel transverse veins arising along dorsal suture and bending or branching longitudinally near center of each valve, not exfoliating. Mesocarp absent. Endocarp dull to glossy, tan, nonseptate. Seeds 3-8, parallel, overlapping, in 1 series. Funiculus up to 40 mm long, filiform, curved.

Seed 28-100 × 9-23 × 1 mm, narrowly oblong to oblong, flattened. Testa dull to glossy and tan to reddish brown on wing and glossy and dark brown to blackish over embryo, rugose, chartaceous, with wing about 5 mm broad, without pleurogram or fracture lines or aril. Hilum punctiform, occluded by wing, flush, marginal to subapical. Lens not discernible. Endosperm absent. Cotyledons notched exposing radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: Tropical Africa.

Notes: The five to seven American species of *Newtonia* section Neonewtonia Burkart have not been assigned a genus name and are reported and discussed under phylogenetic number 3.23 (Lewis and Elias, *1981*). *Newtonia* s.s. is an African genus according to Lewis and Elias. *Newtonia aubrevillei*, an African species, has a spongy layer below the testa that turns softening solutions red.

Newtonia: N. aubrevillei (Pellegrin) Keay (*D*), *N. buchananii* (Baker) Gilbert & Boutique (*F*), *N. hildebrandtii* (Vatke) Torre (*B-C*), *N. klainei* Pierre ex Harms (*A*), *N.* spp. (*E*). *A*, Dehiscent fruit (× 1); *B*, fruit (× 1); *C*, seed in situ (× 1); *D*, cotyledon not concealing radicle (left) and embryonic axis (right) (× 1); *E-F*, testa (× 1, × 50).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Genus: *Piptadeniastrum* Brenan.

Phylogenetic Number: 3.07.

Tribe: Mimoseae.

Group: Newtonia.

Species Studied - Species in Genus: 1 sp. - 1 sp.

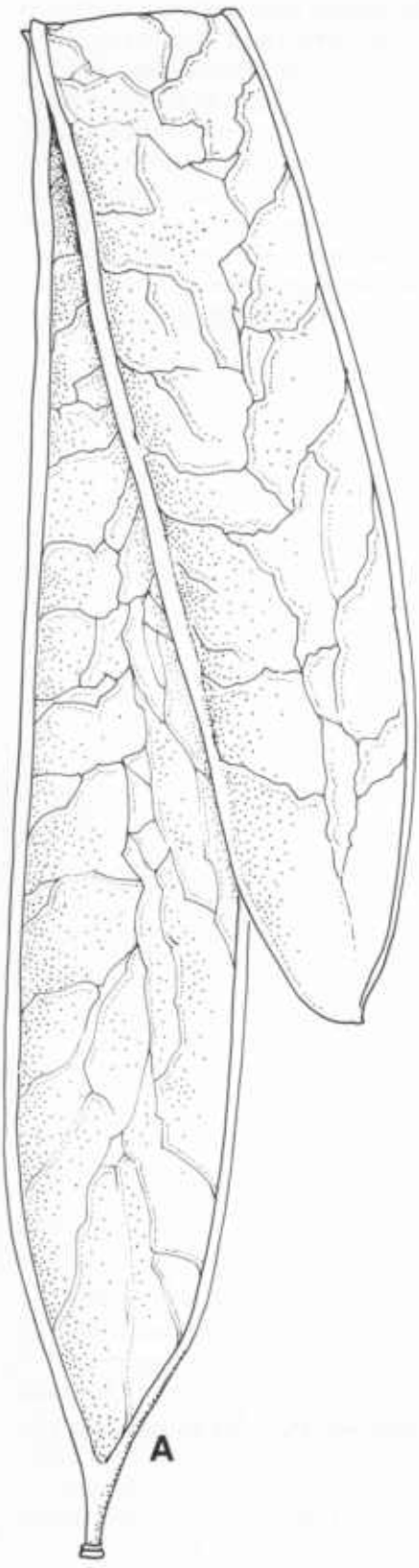
Fruit 25-36 × 2-3.5 × 0.2-0.4 cm, straight to curved, without twists, broadly linear, margin not constricted, short tapered to apex, short tapered to nearly rounded to stipe up to 10 mm long, flattened, coriaceous. Valves dehiscing medially along ventral suture and remaining united along dorsal suture, remaining attached to sutures, without visible seed chambers. Epicarp dull, dark brown, glabrous, regularly and obliquely venose on ventral half of valves and irregularly and shorter venose on dorsal half of valves, not exfoliating. Mesocarp absent. Endocarp dull, reddish brown, reticulate, nonseptate. Seeds 6-14, parallel, overlapping, in 1 series. Funiculus 10-20 mm long, filiform, S-curved.

Seed 30-100 × 15-30 × 1 mm, oblong, flattened. Testa dull to glossy, brown, rugose, chartaceous, with wing entire or notched at 1 or both ends and widest (up to 20 mm) at each end, without pleurogram or fracture lines or aril. Hilum punctiform, occluded by wing, flush, apical according to embryonic axis and marginal according to seed length. Lens not discernible. Endosperm absent. Cotyledons notched exposing radicle. Embryonic axis slightly deflexed and at right angles to seed length. Plumule moderately developed.

Distribution: Senegal to Sudan and Angola.

Notes: Based on seed characters this species is not a *Newtonia* s.s. Fruit characters also support this segregate genus. The venation pattern arising from the central suture of this species is similar to the pattern arising from the dorsal suture of *Newtonia* s.s.

Piptadeniastrum: P. africana (Hooker f.) Brenan (*A-F*). *A*, Fruit (× 0.5); *B, D,* dehiscent fruit with seed in situ (× 0.5, × 1); *C*, cotyledon not concealing radicle (left) and embryonic axis (right) (× 2); *E-F,* testa (× 1, × 50).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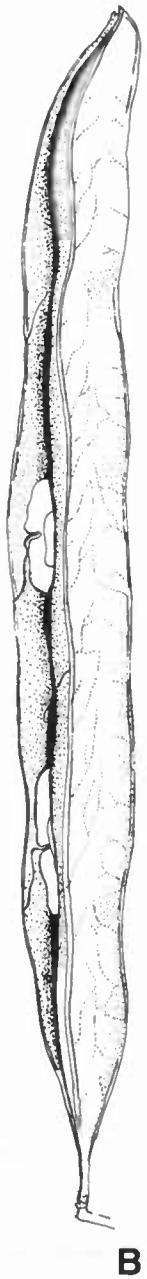
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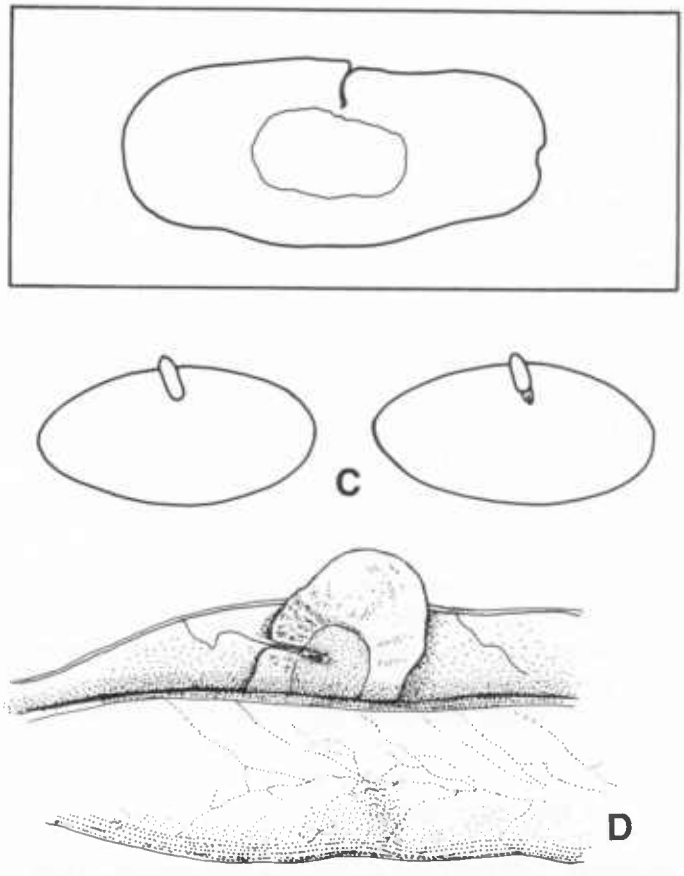
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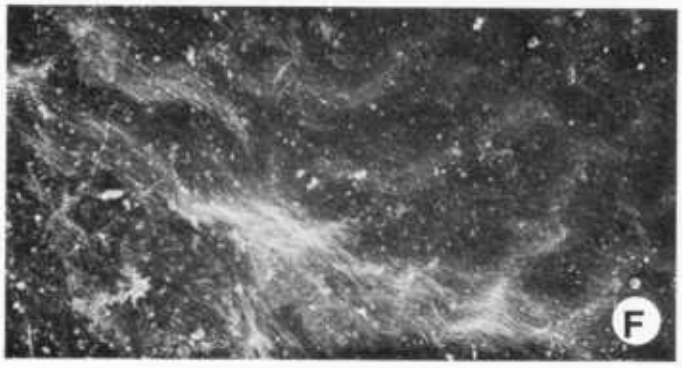
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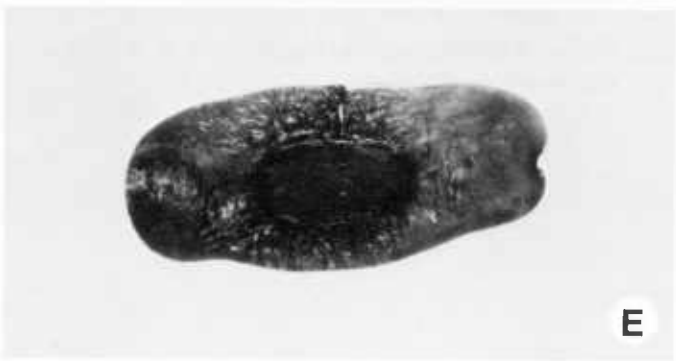
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Genus: *Adenanthera* Linnaeus.

Phylogenetic Number: 3.08.

Tribe: Mimoseae.

Group: Adenanthera.

Species Studied - Species in Genus: 5 spp. - ca. 8 spp.

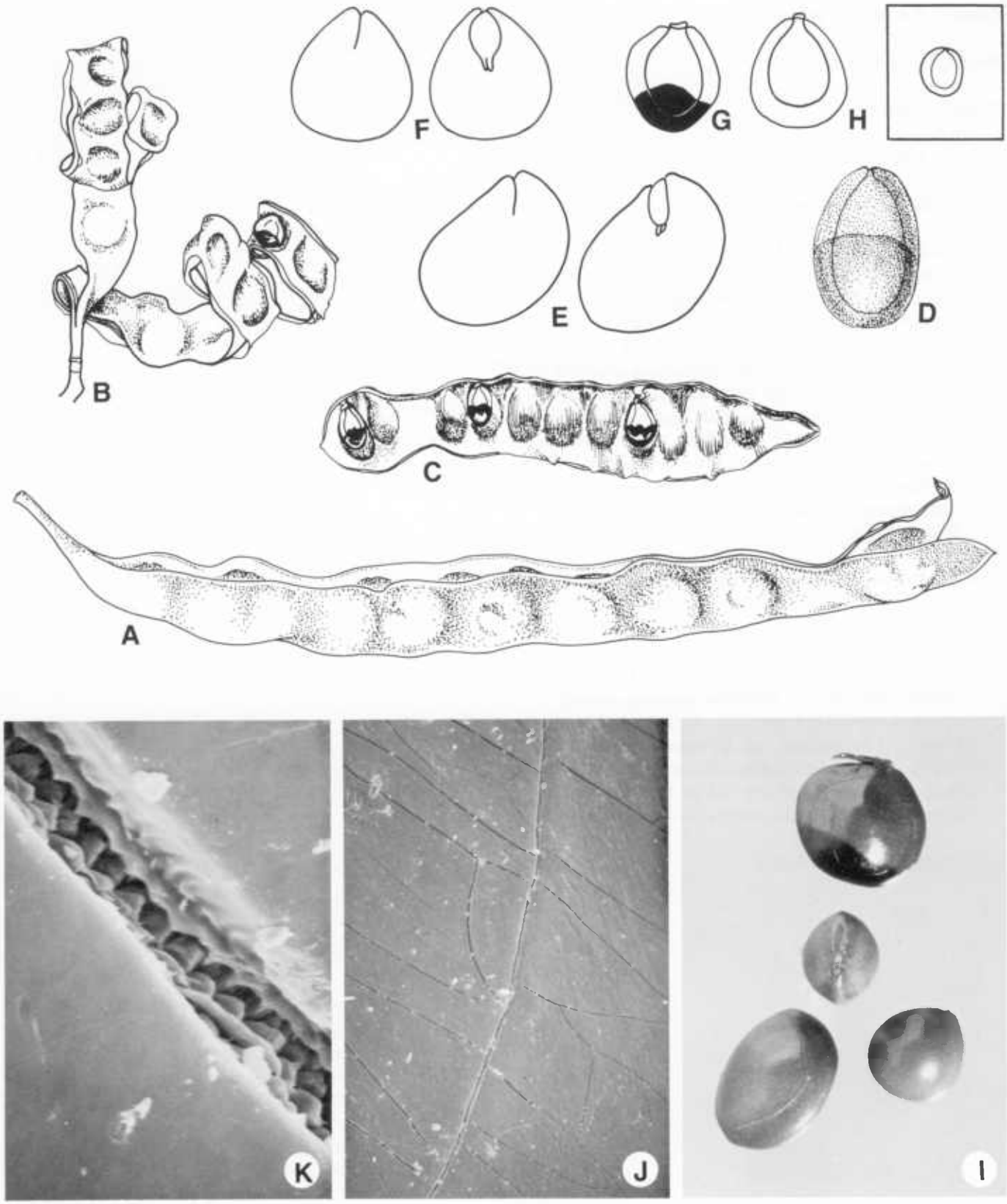
Fruit 8-23 × 10-25 × 0.5-1.2 cm, straight to 1-coiled, with or without twists, linear to oblong, margins not constricted to slightly constricted, short tapered to apex, tapered to stipe 10-20 mm long, compressed, coriaceous to subligneous. Valves dehiscing apically and perhaps medially along both sutures and spreading and curving away from each other or twisting into several coils exposing inner endocarp surface, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown to black, glabrous, smooth but cracking or separating and exfoliating or not. Mesocarp absent to present and spongy. Endocarp glossy, golden to straw-colored nonseptate but chambered. Seeds 10-12, transverse, not overlapping, in 1 series. Funiculus 3-5 mm long, thick, plicate to straight.

Seed 5-10 × 5-10 × 3-6 mm, ovate, compressed. Testa glossy monochrome red or dichrome red (at apex) and black, smooth, osseous, with apically connected or nearly so pleurogram, with or without fracture lines, without wing and aril. Hilum punctiform, concealed by funicular remnant, flush on edge of hilar depression, apical. Lens 0.3-0.8 mm long, oblong to elliptic, slight mound to flush but in hilar depression, red. Endosperm thick to thin, adnate to testa. Cotyledons with simple split over radicle, concealing radicle. Embryonic axis straight or acute angle to hilum. Plumule moderately developed.

Distribution: Tropical Asia and Pacific, with *A. pavonina* widely grown elsewhere.

Notes: All the studied species have seed with bright red monochrome or dichrome (with black) testa. This is a unique character in the Mimosoideae, but it is found in seeds of several genera in the Faboideae and apparently not found in seeds of the Caesalpinioideae. *Adenanthera* seeds are readily separated from the faboid seeds by the apical hilum and presence of the pleurogram. Hutchinson (*1964*) erroneously described fruit "often divided between the seeds by a septum continuous with the endocarp" and seeds "mostly enclosed by a thin pulp."

Adenanthera: *A. abrosperma* F. v. Mueller (*C-D*), *A. bicolor* Moon (*B, E, G*), *A. intermedia* Merrill (*A*), *A. pavonina* Linnaeus var. *microsperma* (Teijsman & Binnendijk) Nielsen (*H*), *A. pavonina* Linnaeus var. *pavonina* (*F, J-K*), *A.* spp. (*I*). *A-B*, Dehiscent fruits (× 1); *C*, seeds in situ (× 1); *D, G, H*, seed topography (× 2); *E-F*, cotyledons concealing radicle (left) and embryonic axis (right) (× 2); *I-K*, testa (× 2, × 50, × 1,000).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Genus: *Tetrapleura* Bentham.

Phylogenetic Number: 3.09.

Tribe: Mimoseae.

Group: Adenanthera.

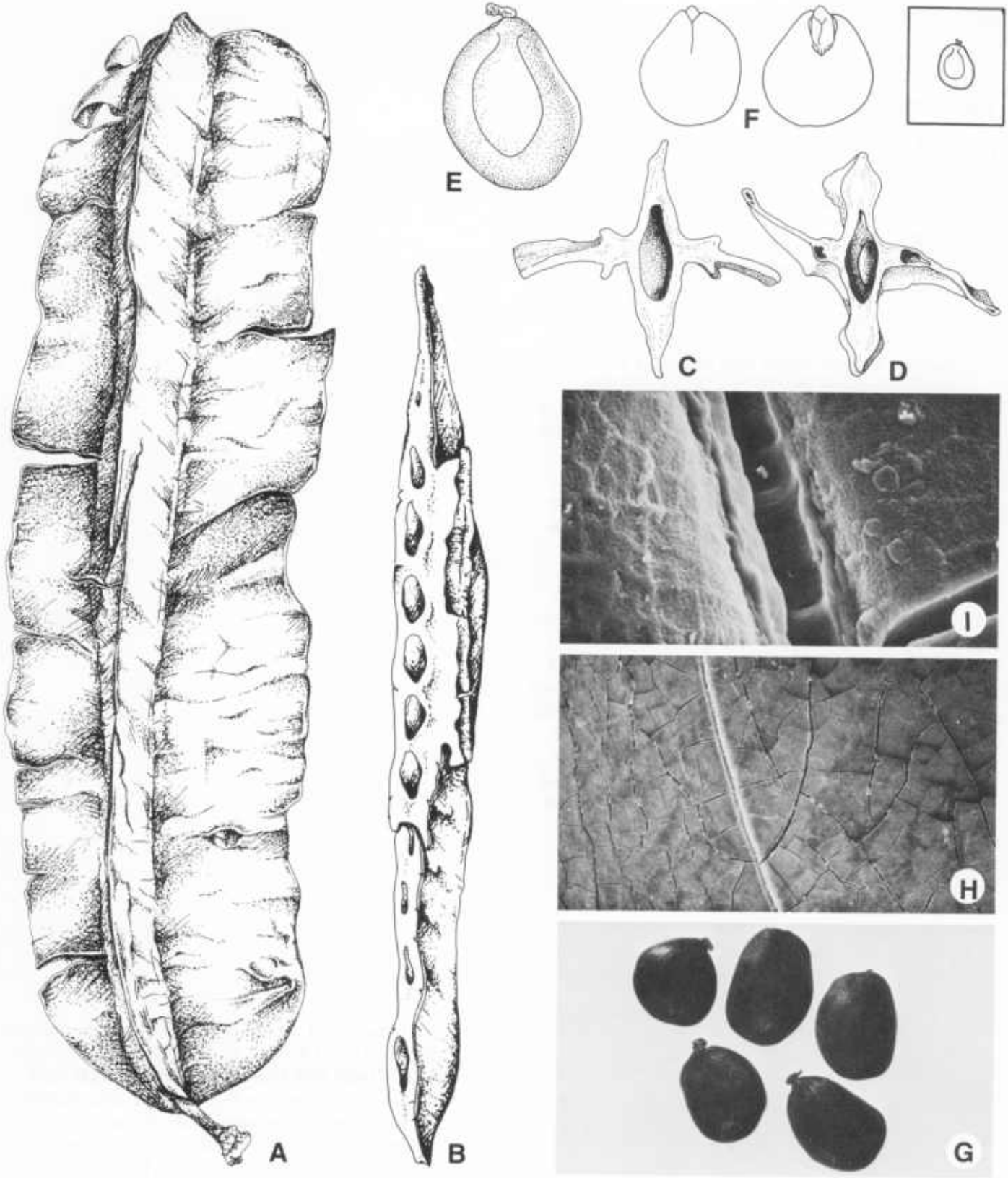
Species Studied - Species in Genus: 1 spp. - 2 spp.

Fruit 12-25 × 2.5-7 × 3.5-7 cm, straight to curved, without twists, oblong and 4-sided, margins not constricted, rounded to emarginate to apex, rounded to stipe 5-10 mm long, cruciform, ligneous. Valves indehiscent, with 2 winglike longitudinal ridges about 2 cm wide, remaining attached to sutures, without visible seed chambers. Epicarp glossy, dark brown to purplish brown, glabrous, more or less smooth but cracking, not exfoliating. Mesocarp spongy, thin layer. Endocarp dull, ocher to brown, septate. Seeds 12-14, transverse, not overlapping, in 1 series. Funiculus 3-4 mm long, thick, plicate.

Seed 9-9.5 × 6-8.5 × 3-6 mm, ovate, compressed. Testa dull, dark to blackish brown, smooth, osseous, with often misshaped pleurogram connected or nearly so at apex, with fracture lines present to rarely present, without wing and aril. Hilum punctiform, concealed by funicular remnant, raised, apical. Lens 0.5-0.7 mm long, elliptic to oblong, mound in depression, tan. Endosperm thick, encasing embryo. Cotyledons with simple split over radicle, concealing all but radicle tip. Embryonic axis straight. Plumule moderately developed.

Distribution: Tropical Africa.

Tetrapleura: T. tetraptera (Schumacher & Thonning) Taubert (*A-I*). *A*, Fruit (× 1); *B*, longitudinal section of fruit through endocarp showing separate seed chambers (× 1); *C-D*, transverse section of fruit through seed chambers (left empty and right with seed in situ) (× 1); *E*, seed topography (× 3); *F*, cotyledon concealing all but tip of radicle (left) and embryonic axis (right); *G-I*, testa (× 2, × 50, × 1,000).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Genus: *Amblygonocarpus* Harms.

Phylogenetic Number: 3.10.

Tribe: Mimoseae.

Group: Adenanthera.

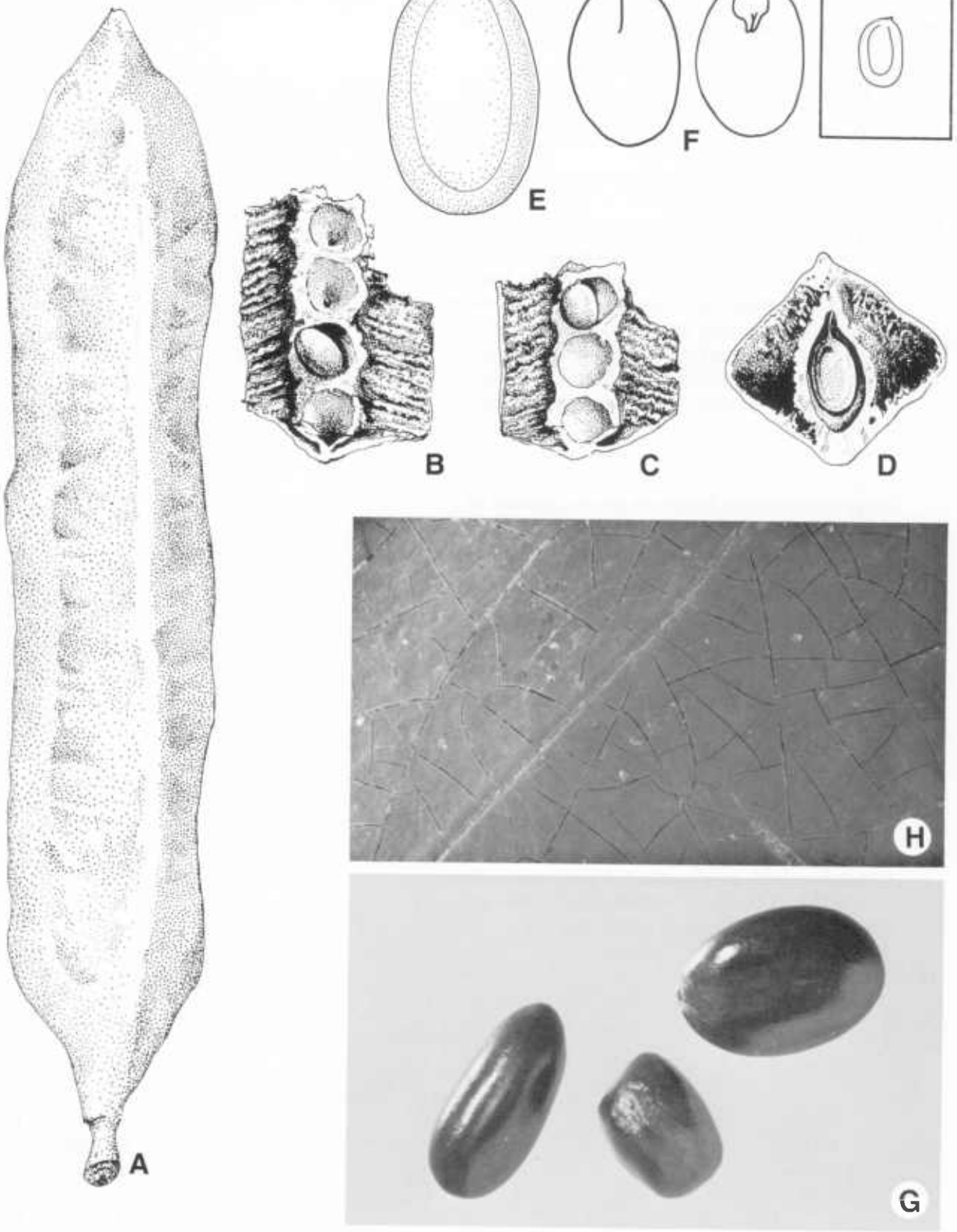
Species Studied - Species in Genus: 1 sp. - 1 sp.

Fruit 8-20 × 1.8-3.5 × 2-2.3 cm, straight or nearly so, without twists, oblong, margins not constricted, blunt to short tapered to apex, short tapered to stipe 7-40 mm long, quadrangular to subterete, ligneous. Valves indehiscent, remaining attached to sutures, without visible seed chambers but with regularly spaced depressions. Epicarp glossy, brown to blackish, glabrous, smooth but dimpled at regular intervals over seed chambers, not exfoliating. Mesocarp spongy, partially filling cavity. Endocarp dull, straw-colored, ligneous, septate. Seeds 10-15, transverse, not overlapping, in 1 series. Funiculus 10-15 mm long, filiform, straight.

Seed 10-13 × 7-9 × 4-6 mm, oblong, compressed. Testa glossy, either monochrome dark brown or occasionally streaked with pale brown, smooth osseous, with pleurogram nearly connected at apex and fracture lines, without wing and aril. Hilum punctiform, concealed by funicular remnant, flush and surrounded by colored or textured halo, apical. Lens 0.7 mm long, linear, flush and within halo, tan. Endosperm thick, encasing embryo. Cotyledons with simple split over radicle, concealing all but radicle tip. Embryonic axis straight. Plumule moderately developed.

Distribution: Africa (savannas).

Amblygonocarpus: A. andongensis (Welwitsch ex Oliver) Exell & Torre (*A-H*). *A*, Fruit (× 1); *B-C*, longitudinal section of fruit through seed chambers (× 1); *D*, transverse section through seed chamber (× 1); *E*, seed topography (×4); *F*, cotyledon concealing all but tip of radicle (left) and embryonic axis (right) (× 3); *G-H*, testa (× 2, × 50).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Genus: *Pseudoprosopis* Harms.

Phylogenetic Number: 3.11.

Tribe: Mimoseae.

Group: Adenanthera.

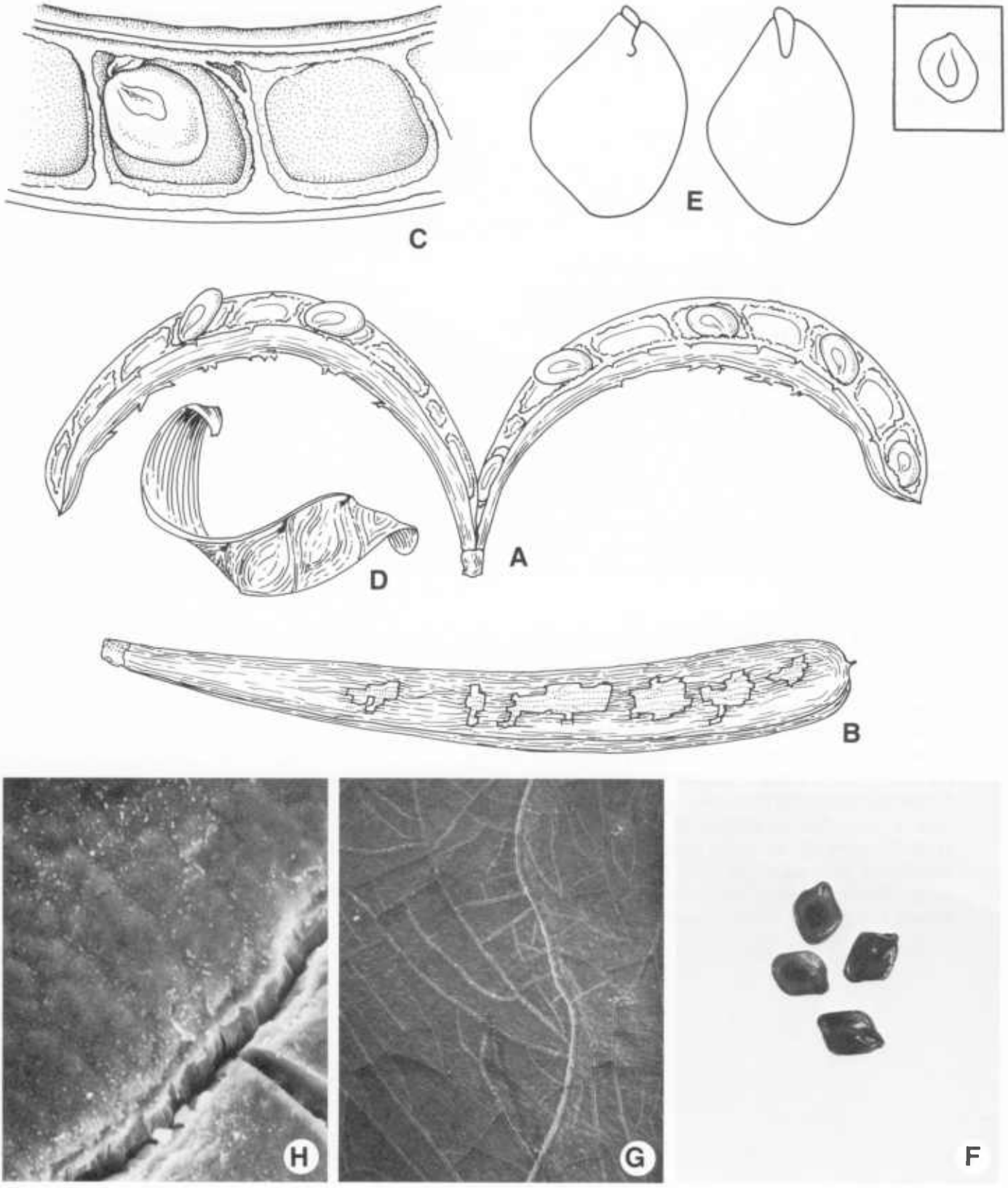
Species Studied - Species in Genus: 3 spp. - 4 spp.

Fruit 7-16 × 1-2.2 × 0.6-1.3 cm, straight to slightly curved, without twists, oblong, margins not constricted, rounded to apex, long tapered to base, substipitate, compressed, ligneous. Valves dehiscing apically and recurving along both margins with 1 valve often breaking free at base, remaining attached to sutures, without visible seed chambers. Epicarp glossy to dull, black, pubescent when young and glabrous with age, faintly obliquely longitudinally striate, checking and exfoliating. Mesocarp fibrous, ligneous. Endocarp dull, straw-colored tinged with brown to brown, septate to nonseptate and with tan line between seeds. Seeds 8–9, oblique, not overlapping, in 1 series. Funiculus 3 mm long, thick, curved.

Seed 7-18 × 5-11 × 3 mm, elliptic to rhombic or subquadrangular-circular, compressed. Testa glossy, brown, smooth, coriaceous, with (or without based on immature seeds of *P. claessensii* (de Wildemann) Gilbert & Boutique) irregular 75 percent pleurogram and fracture lines especially along each side of pleurogram, without wing and aril. Hilum punctiform, concealed by funicular remnant, flush, subapical. Lens 0.5-0.7 mm long, triangular, mound, tan fringed with black. Endosperm absent. Cotyledons with basally groined split over radicle, concealing all but tip of radicle. Embryonic axis slightly deflexed. Plumule rudimentary.

Distribution: Tropical Africa.

Pseudoprosopis: P. euryphylla Harms (*D*), *P. fischeri* (Taubert) Harms (*A-C, E-H*). *A*, Dehiscent fruit (× 1); *B*, valve (× 1); *C*, seed in situ (× 2); *D*, valve (× 1); *E*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 3); *F-H*, testa (× 1, × 50, × 1,000).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Genus: *Elephantorrhiza* Bentham.

Phylogenetic Number: 3.12.

Tribe: Mimoseae.

Group: Entada.

Species Studied - Species in Genus: 5 spp. - 9 spp.

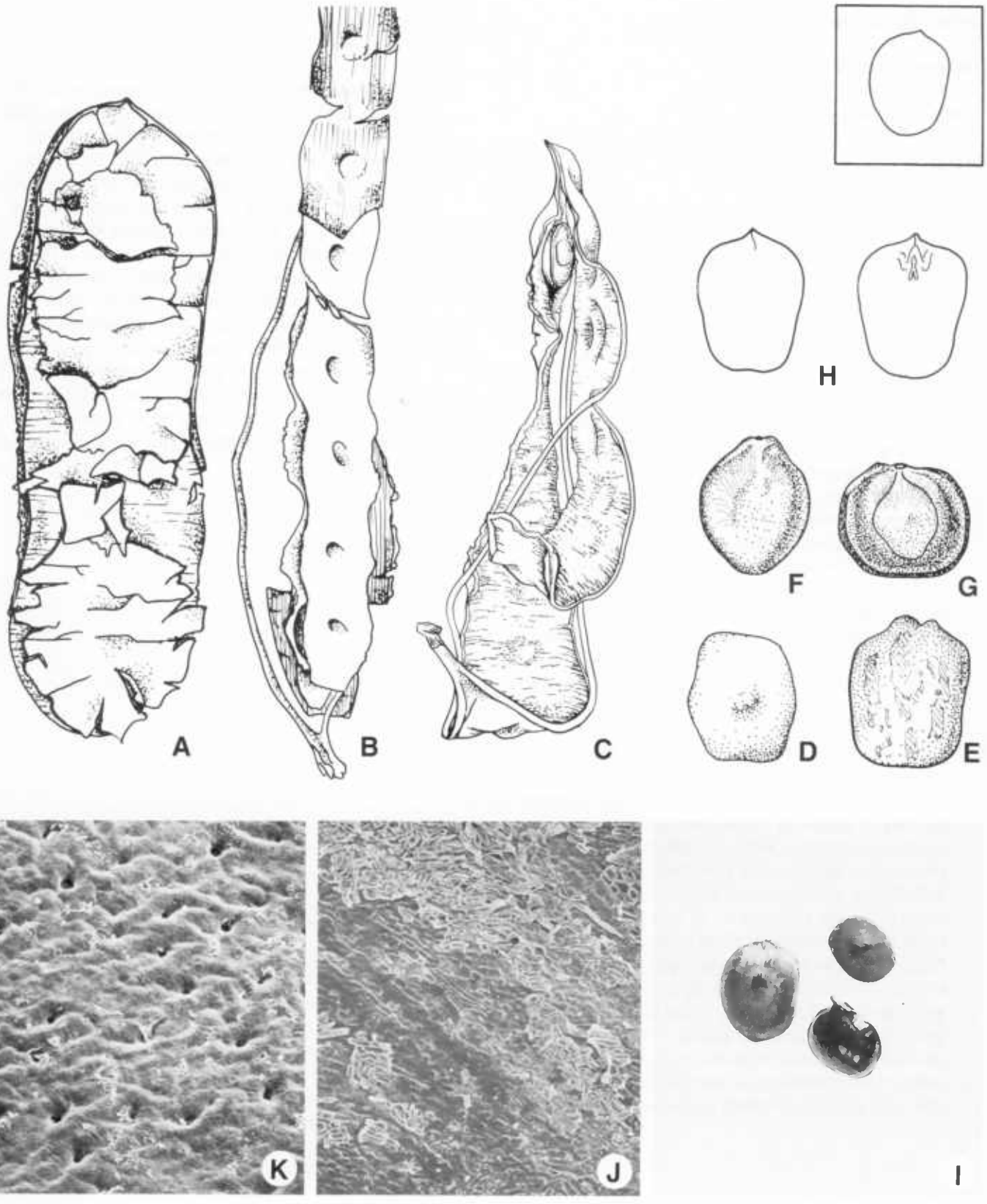
Fruit (5-)8.5-45 × 1.3-7 × 0.05-0.1 cm, straight to falcate or curved, without twists, oblong to linear, margins not constricted, rounded to tapered apex, rounded to tapered to stipe 5-10 mm long, compressed to nearly flattened, coriaceous to ligneous. Valves dehiscing apically to medially along both margins, separating from replum, with or without visible seed chambers. Epicarp dull, dark brown to blackish brown or dark reddish brown to purplish brown, glabrous, prominently to obscurely transversely venose, exfoliating often in large segments. Mesocarp absent. Endocarp dull, tan, nonseptate to subseptate. Seeds 10-12, transverse, not overlapping, in 1 series. Funiculus 1.5 mm long, thick, curved.

Seed 9-26 × 8-18 × 3.5-13 mm, elliptic to circular or tending to be quadrangular, compressed and with umbo centered in areola to nearly terete and without umbo. Testa glossy to dull, black with white to tan patches of endocarp or enclosed by coriaceous endocarp tissue, minutely sculptured-pitted-rugose, osseous, without pleurogram except *E.* sp. with 90 percent pleurogram, without fracture line or wing or aril. Hilum punctiform to minutely elliptic, exposed, recessed, subapical. Lens not discernible. Endosperm thin, adnate to testa. Cotyledons with simple split over radicle, concealing radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: Africa (south of the equator).

Notes: *Elephantorrhiza* species (*C* and *G*) is an anomaly: The only studied species in the genus with pleurogrammatic seeds. In all other seed and fruit characters, this is a species of *Elephantorrhiza*. It is incorrectly identified as *E. goetzei* (Harms) Harms; was collected by Monro, 1909, in Africa; and is deposited in the carpology collection of the British Museum (Natural History). Ross (*1974, 1977*) has studied this genus.

Elephantorrhiza: E. burkei Bentham (*F, H, J*), *E. elephantina* (Burchell) Skeels (*A, E*), *E. suffruticosa* Schinz (*B, D, K*), *E.* species (*C, G*), *E.* spp. (*I*). *A-C*, Dehiscing fruits (× 1); *D-G*, seed topography (× 1.5); *H*, cotyledon concealing radicle (left) and embryonic axis (right) (× 1.5); *I-K*, testa (× 1, × 50, × 50).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Genus: *Entada* Adanson.

Phylogenetic Number: 3.13.

Tribe: Mimoseae.

Group: Entada.

Species Studied - Species in Genus: 13 spp. - ca. 30 spp.

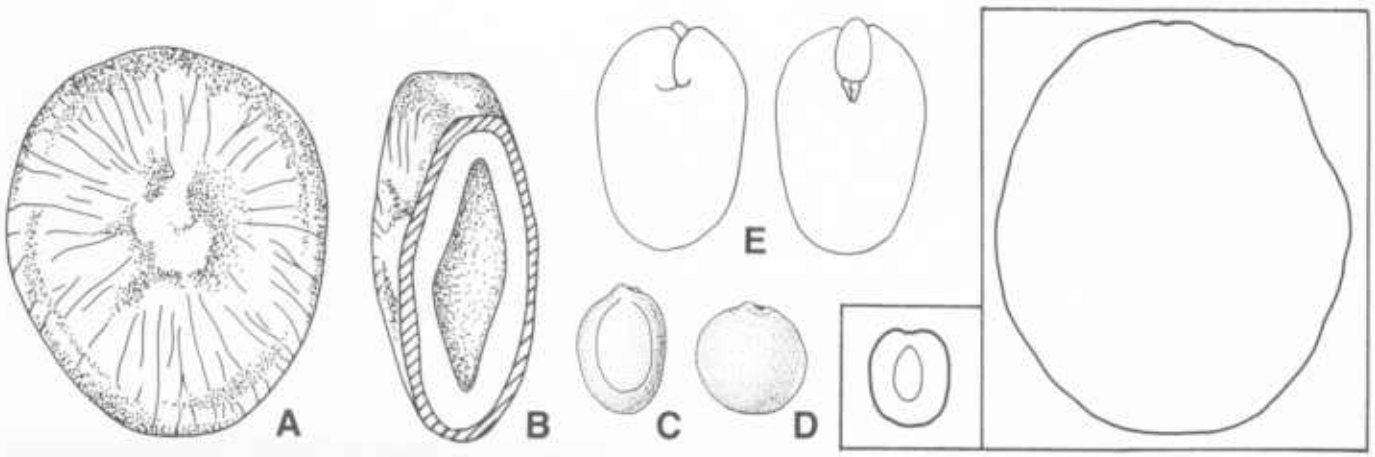
Fruit 1-200 × 2-15 × 0.3-30 cm, straight to 1-coiled, without or with twists, oblong, margins slightly constricted to constricted to ventral margin slightly constricted and dorsal constricted, rounded to apex, short tapered to stipe up to 35 mm long or substipitate, compressed to terete, chartaceous to ligneous (rarely fleshy when fresh). Valves indehiscent, with or without (in largest fruits) transverse joints separating from each other and replum into 1-seeded winged endocarp segments, with visible seed chambers. Epicarp dull, brown, glabrous, reticulate, exfoliating. Mesocarp absent or present, fibrous, ligneous. Endocarp dull, monochrome ocher to straw-colored to mottled with brown, darker in seed chambers for most winged endocarps, segments winged and subcoriaceous or nonwinged and ligneous, septate to nonseptate. Seeds 6-14, transverse to oblique, not overlapping, in 1 series. Funiculus 15-33 mm long, filiform, hooked to plicate.

Seed 5-80 × 3-70 × 1-40 mm, circular to oblong or irregular, terete to flattened. Testa glossy to dull, dark brown occasionally with adnate tan to ocher patches of endocarp tissue, smooth to rugose, osseous to coriaceous, with or without 90-100 percent pleurogram and fracture lines, without wing or aril. Hilum punctiform or elliptic to linear and on some of largest seeds up to 15 mm long and tan to color of testa, exposed, flush to recessed, apical. Lens either not discernible on large nonpleurogrammatic seeds or discernible on smaller pleurogrammatic seeds and 0.5-0.7 mm long, oblong, mound, tan. Endosperm absent. Cotyledons either notched with radicle exposed or auriculate over radicle and concealing all but radicle tip. Embryonic axis straight. Plumule moderately developed.

Distribution: Pantropic and subpantropic (most numerous in Africa).

Notes: Fruit and seed characters in this genus are divisive and are used to subdivide the genus. Brenan (*1966*) in revising *Entada* for "Flora Zambesiaca" described sections and subsections for all *Entada* spp. of the world but assigned only African species to his two subgenera (*Entada* and *Acanthentada* Brenan now the genus *Pseudoentada* Britton & Rose). Brenan opined that "there is not sufficient justification for recognizing generic segregates from *Entada* in Africa, at least for the time being." Lewis and Elias (*1981*) recognized *Entada* and *Pseudoentada*. Perhaps a critical revision of *Entada* will resolve the problem created by having species with such disparate fruit and seed characters in the same genus. The seeds of *E. gigas* and *E. phaseoloides* are wide ranging drift seeds (Gunn et al., *1976*).

Entada seeds: *E. abyssinica* Steudel ex A. Richard (*C, I*), *E. gigas* (Linnaeus) Fawcett & Rendle (*A-B, H*), *E. glandulosa* Pierre ex Gagnepain (*D*), *E. polystachya* (Linnaeus) de Candolle (*E*), *E. pursaetha* de Candolle (*F*), *E.* spp. (*G*). *A, C, D,* Seed topography (× 1); *B,* seed in longitudinal section showing cavity between cotyledon (× 1); *E,* cotyledon concealing all but tip of radicle (left) and embryonic axis (right) (× 1); *F-I,* testa (× 1, × 2, × 50, × 1,000).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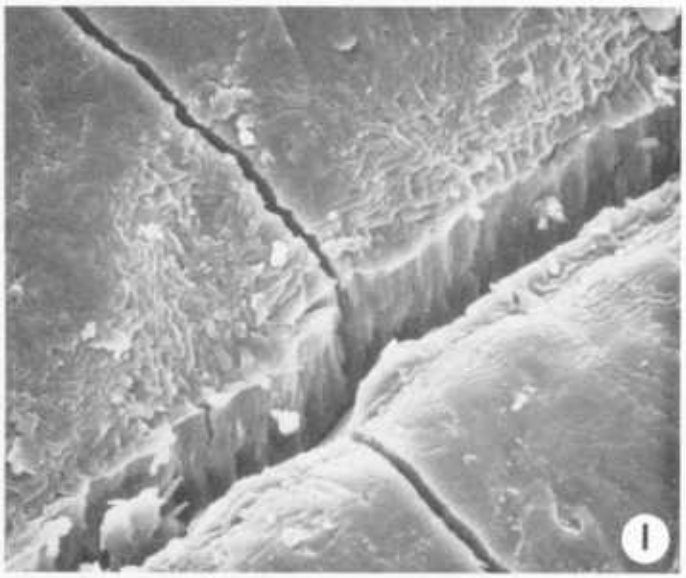
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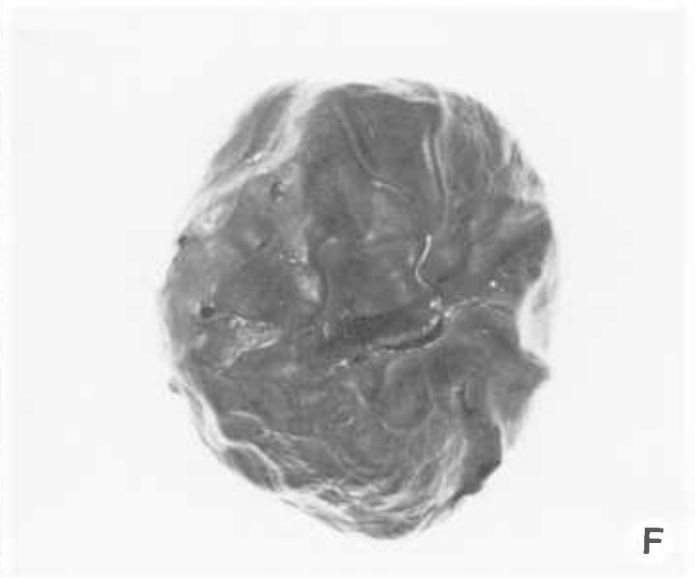
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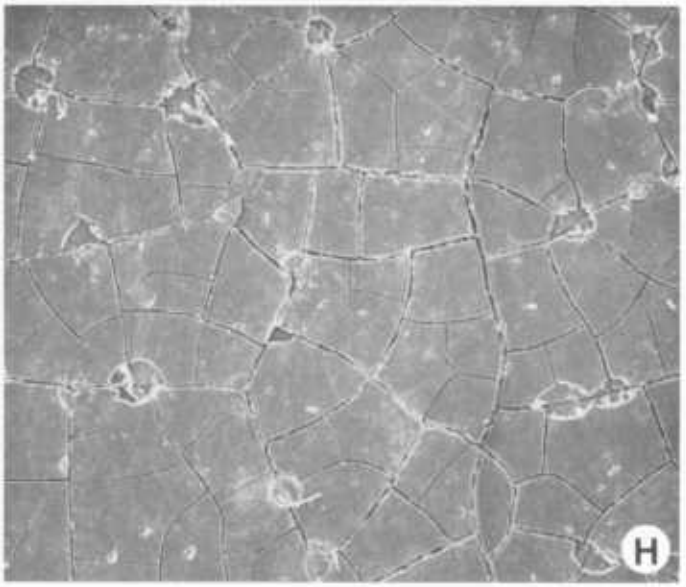
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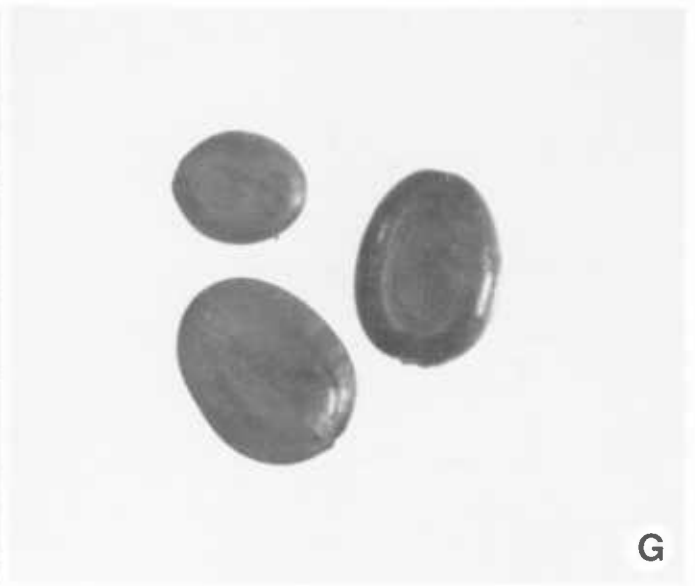
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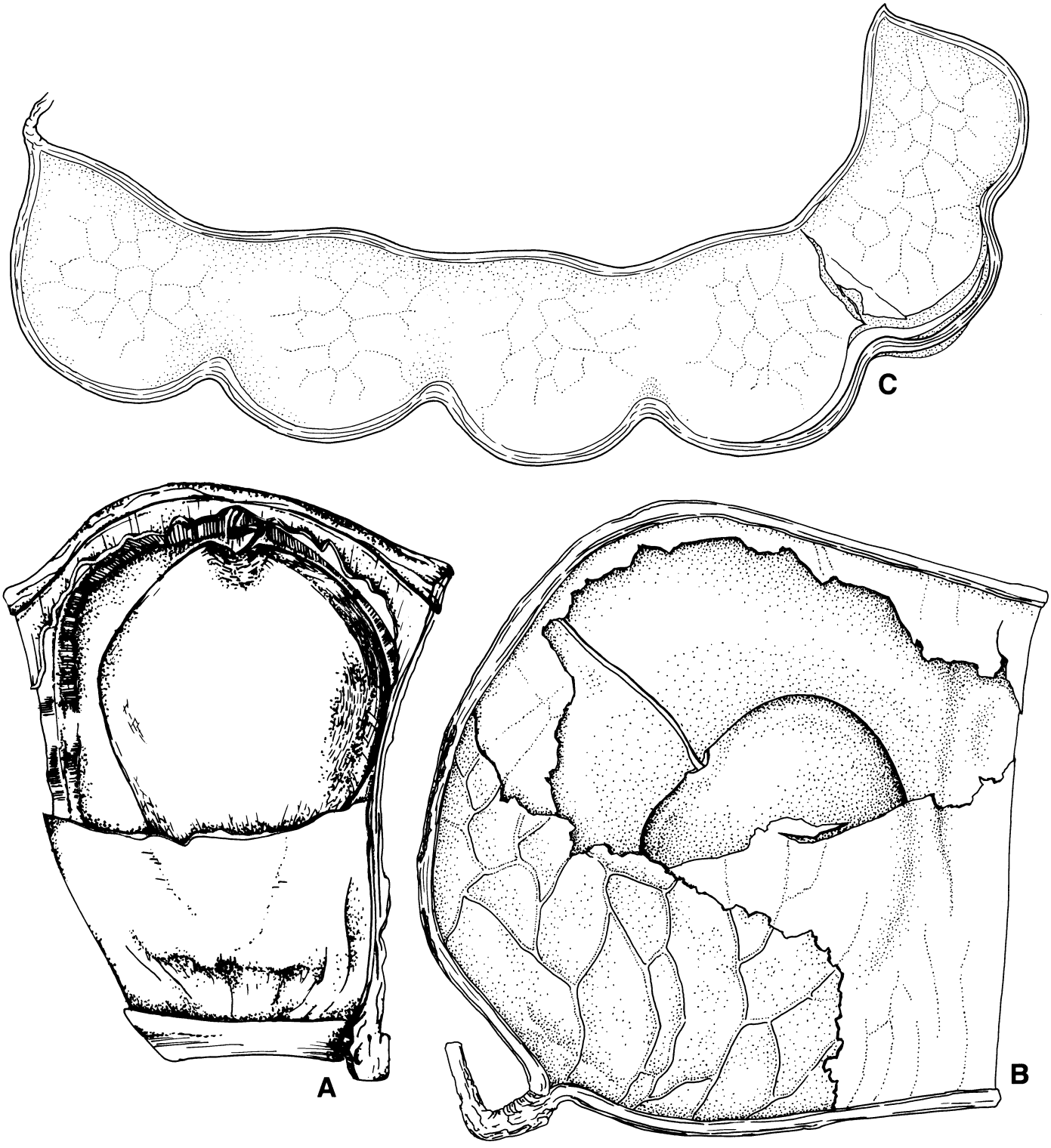
Entada fruits: *E. gigas* (Linnaeus) Fawcett & Rendle (*B-C*), *E. phaseoloides* (Linnaeus) Merrill (*A*). *A-B*, Partial seeds in situ (× 1); *C*, fruit (× 0.5).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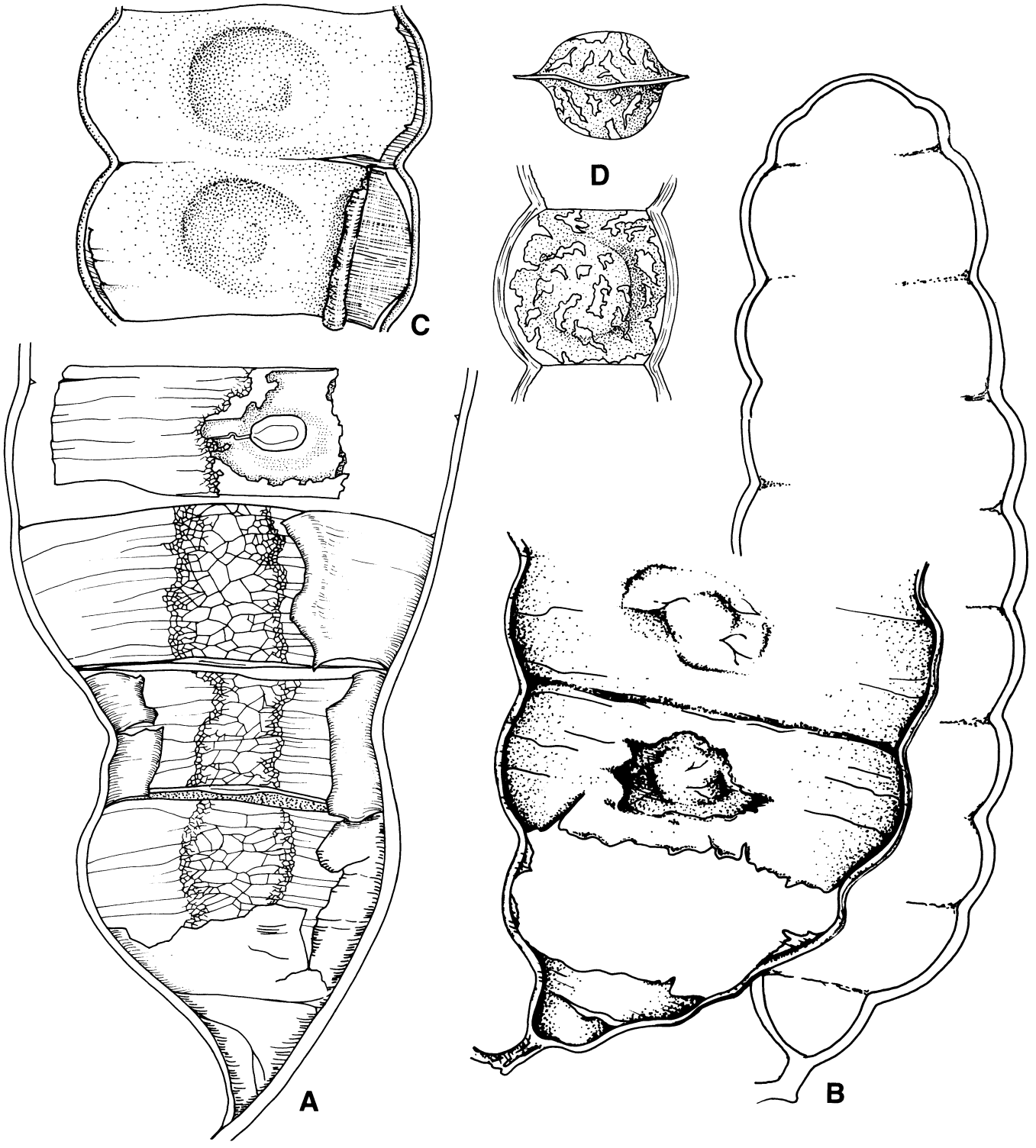
Entada fruits (con.): *E. abyssinica* Steudel ex A. Richard (*B*), *E. africana* Guillemin & Perrottet (*C*), *E. glandulosa* Pierre ex Gagnepain (*D*), *E. polystacha* (Linnaeus) de Candolle (*A*). *A,* Partial fruit showing 1-seeded fruit segments, indurate replum, seed in situ within fruit segment (× 1); *B*, entire fruit (background) (× 0.5) and partial fruit (foreground) (× 1); *C-D,* fruit segments (× 1).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Genus: *Plathymenia* Bentham.

Phylogenetic Number: 3.14.

Tribe: Mimoseae.

Group: Plathymenia.

Species Studied - Species in Genus: 2 spp. - 4 spp.

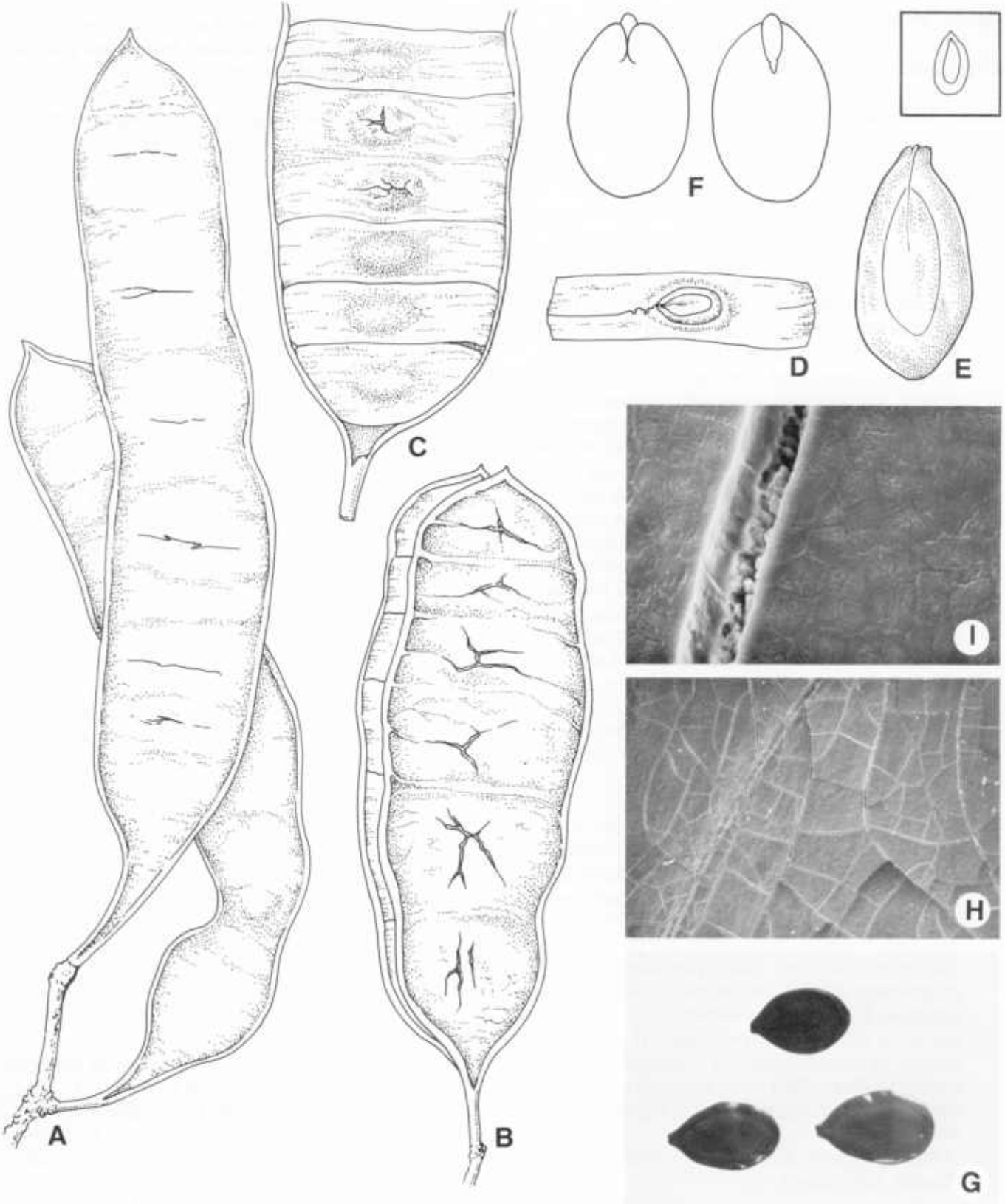
Fruit 7-17 × 1.5-5 × 0.2-0.3 cm, straight, without twists, oblong to linear, margins slightly constricted to constricted especially near apex or base, rounded to apex, short to long tapered to stipe 10-20 mm long, flattened, coriaceous to ligneous. Valves with epicarp and mesocarp but not endocarp dehiscing from apex to base along both sutures and endocarp segmented and breaking into 1-seeded winged segments, epicarp and mesocarp (not endocarp) remaining attached to sutures, without or with visible seed chambers. Epicarp dull, brown to black, glabrous, smooth to faintly venose, checking and exfoliating. Mesocarp solid, coriaceous to ligneous. Endocarp dull, ocher but darker above and below seed, separating into 1-seeded winged segments, septate. Seeds 8-19, transverse, not overlapping, in 1 series. Funiculus to 25 mm long, filiform, contorted.

Seed 7-11 × 4-6 × 1-2 mm, ovate to oblong, compressed. Testa dull to glossy, medium brown, smooth but with line to groove arising near micropyle crossing pleurogram terminating at faint umbo, coriaceous, with 100 percent pleurogram and fracture lines, without wing and aril. Hilum punctiform, exposed, recessed, apical. Lens either discernible and 0.4 mm long, oblong, mound, tan surrounded by darker brown or barely discernible as mound of dark-brown tissue. Endosperm thin, adnate to testa. Cotyledons with simple split or auriculate over radicle, concealing all but radicle tip or 75 percent of radicle exposed. Embryonic axis straight. Plumule rudimentary.

Distribution: Tropical South America.

Notes: *Plathymenia* spp. "dehisce" 1-seeded, winged, indehiscent endocarp segments similar to *Wallaceodendron* Koorders.

Plathymenia: P. foliolosa Bentham (*C-F, H-I*), *P. reticulata* Bentham (*A-B*), *P.* spp. (*G*). *A,* Two fruits (× 1); *B,* dehiscent fruit (× 1); *C,* partial fruit with epicarp and mesocarp removed (× 1); *D,* 1-seeded endocarp segments with seed in situ (× 1); *E,* seed topography (× 4); *F,* cotyledons concealing all but radicle tip (left) and embryonic axis (right) (× 4); *G-I,* testa (× 2, × 50, × 1,000).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Genus: *Prosopis* Linnaeus.

Phylogenetic Number: 3.15.

Tribe: Mimoseae.

Group: Prosopis.

Species Studied - Species in Genus: 24 spp. - 44 spp.

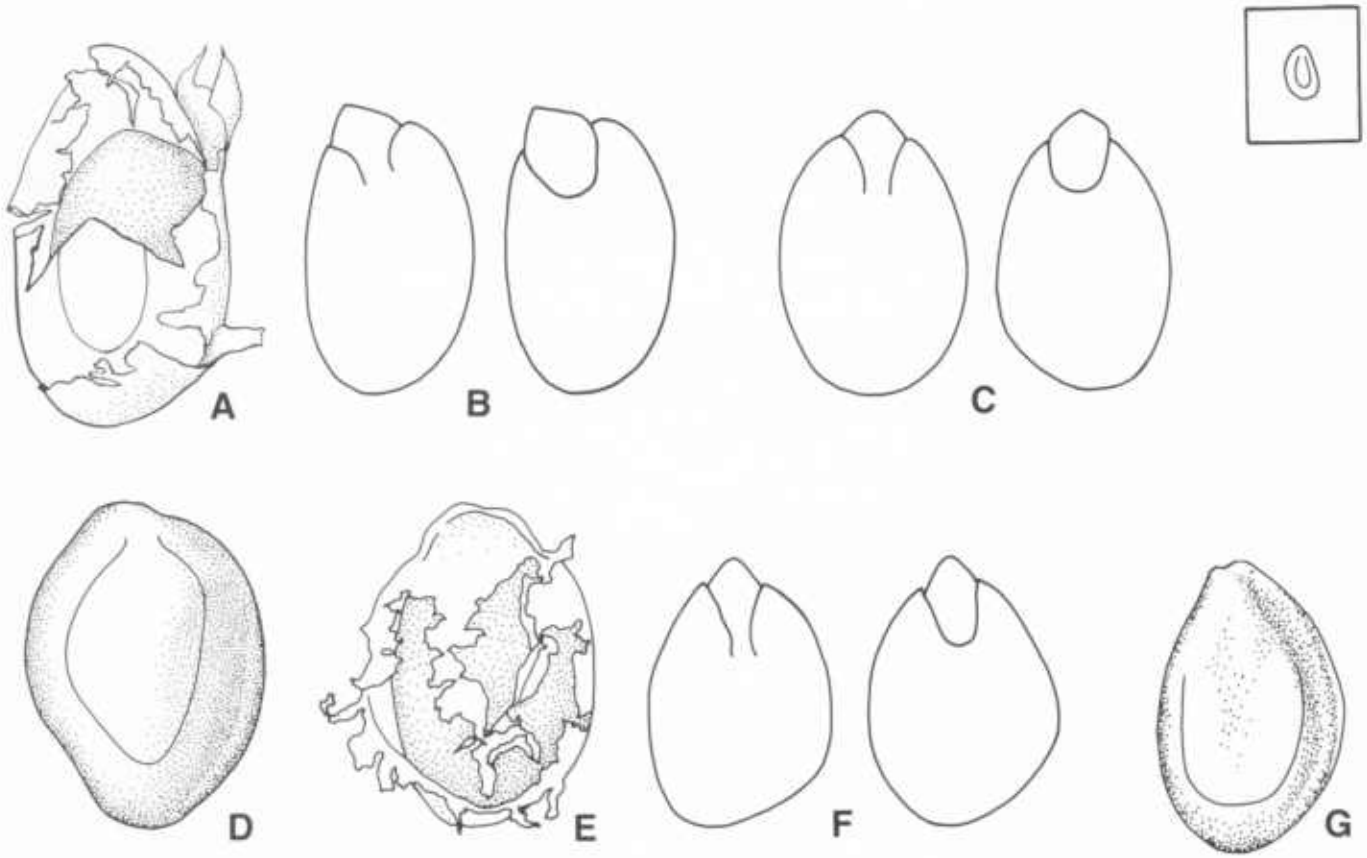
Fruit 1.5-29 × 0.4-2.6 × 0.3-2.5 cm, either straight to S-curved or 1-coiled and without twists or loosely to tightly spirally coiled into cylinder, oblong to linear or moniliform, not constricted to constricted or ventral margin constricted and dorsal margin not constricted, rounded to short tapered to apex, short tapered to rounded to stipe up to 20 mm long to nonstipitate, compressed to terete some fleshy when fresh and all coriaceous to ligneous with age. Valves indehiscent, remaining attached to sutures, with or without visible seed chambers. Epicarp glossy to dull, brown (various shades and in combination with other colors), glabrous to velutinous, obscurely or prominently longitudinally reticulate, not exfoliating. Mesocarp spongy to fibrous, thin to thick, coriaceous to ligneous. Endocarp dull to glossy, brown (various shades and in combination with other colors) to black, nonseptate or subseptate to septate, some separating into 1-seeded osseous segments and others pulpy. Seeds 6-35, transverse to oblique, not overlapping, in 1 series. Funiculus 5-7 mm long, filiform, S-curved to contorted.

Seed 6-10 × 3.5-6 × 2.5-4 mm, ovate to elliptic or irregular, compressed to terete especially when umbo present. Testa glossy, black to grayish green or brown to reddish brown with areola same or different color from rest of surface, smooth, osseous, with 75 percent pleurogram and fracture lines, without wing and aril. Hilum punctiform, exposed or concealed by funicular remnant, flush, apical to subapical. Lens either not discernible or discernible and up to 0.5 mm long, punctiform to elliptic or circular to triangular, mound to pit, whitish to grayish to darker than testa. Endosperm thick, encasing embryo or adnate to testa. Cotyledons auriculate over radicle, concealing only margins of radicle. Embryonic axis straight to slightly deflexed. Plumule rudimentary.

Distribution: Western North America to Argentina (Patagonia), southwest Asia, Africa, and planted or established elsewhere.

Notes: *Prosopis* was monographed by Burkart (*1976*), who was able to accommodate the diverse fruit characters in one genus.

Prosopis seeds: *P. farcta* (Solander ex Russell) Macbride (*C, G*), *P. palmeri* S. Watson (*D-F, I-J*), *P. pubescens* Bentham (*A-B*), *P.* spp. (*H*). *A, E,* Seeds with exfoliating cuticle (× 5); *B, C, F,* cotyledons not concealing radicle (left) and embryonic axis (right) (× 5); *D, G,* seed topography (× 5); *H-J,* testa (× 2, × 50, × 1,000).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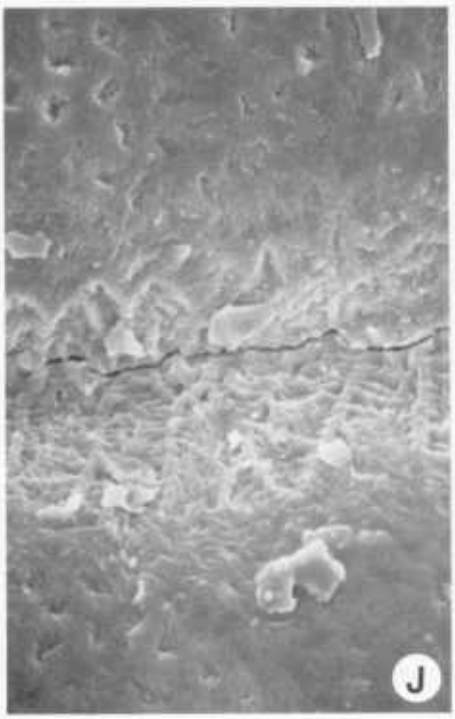
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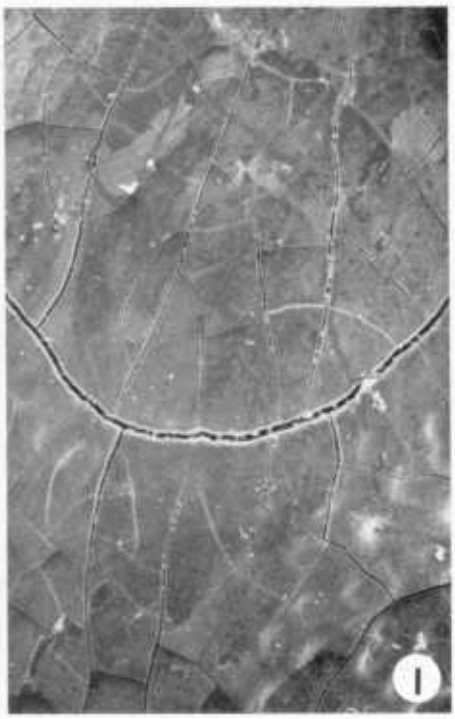
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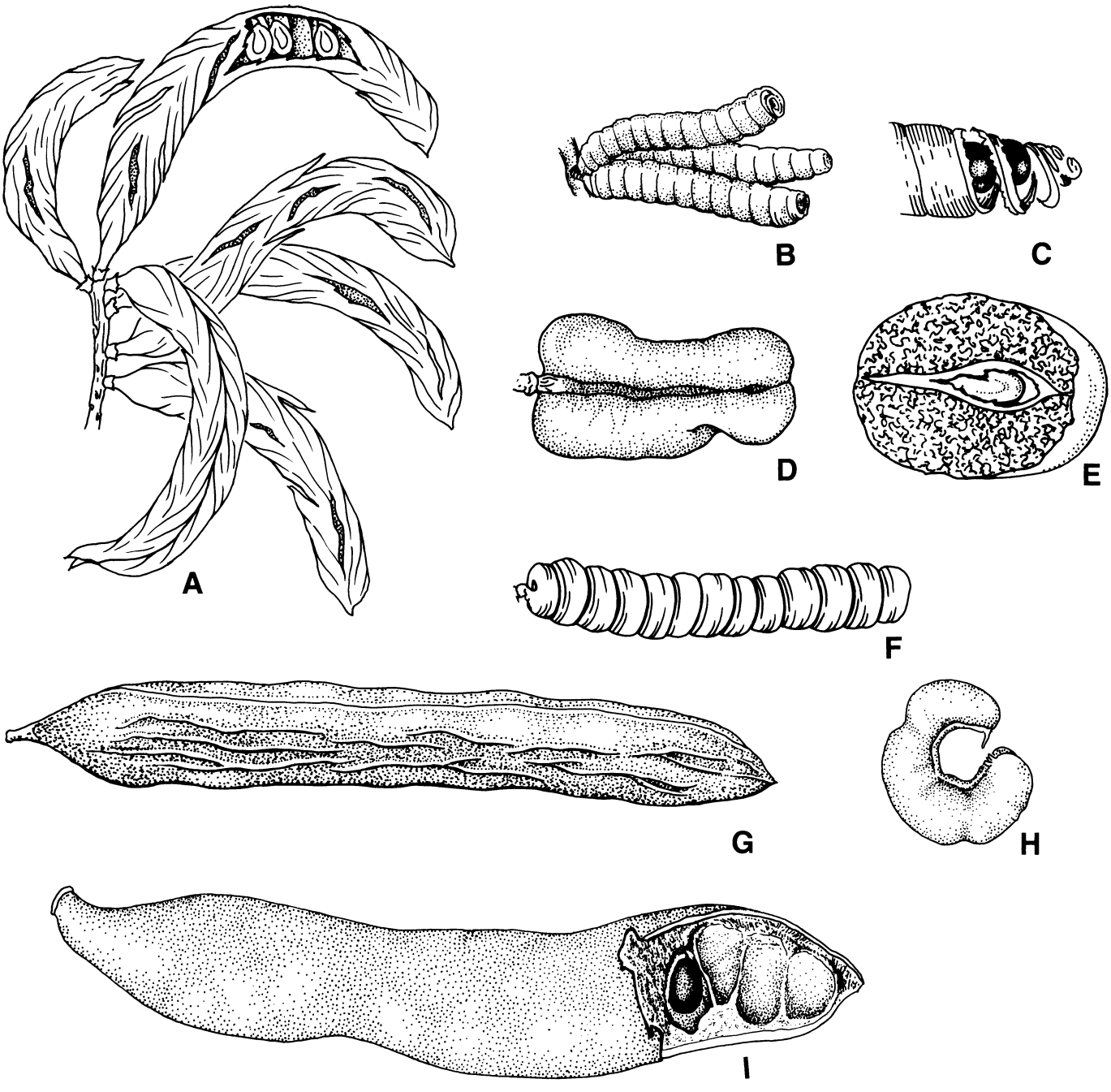
Prosopis fruits: *P. africana* (Guillemin & Perrottet) Taubert (*I*), *P. farcta* (Solander ex Russell) Macbride (*D-E*), *P. kuntzei* Harms (*G*), *P. palmeri* S. Watson (*A*), *P. pubescens* Bentham (*B-C*), *P. strombulifera* (Lamarck) Bentham (*F*), *P. tamarugo* Philippi (*H*). *A-B*, Fruit clusters (× 1); *C, I,* seeds in situ (× 2, × 1); *D, F-H,* fruits (× 1); *E*, fruit with seed in situ (× 2).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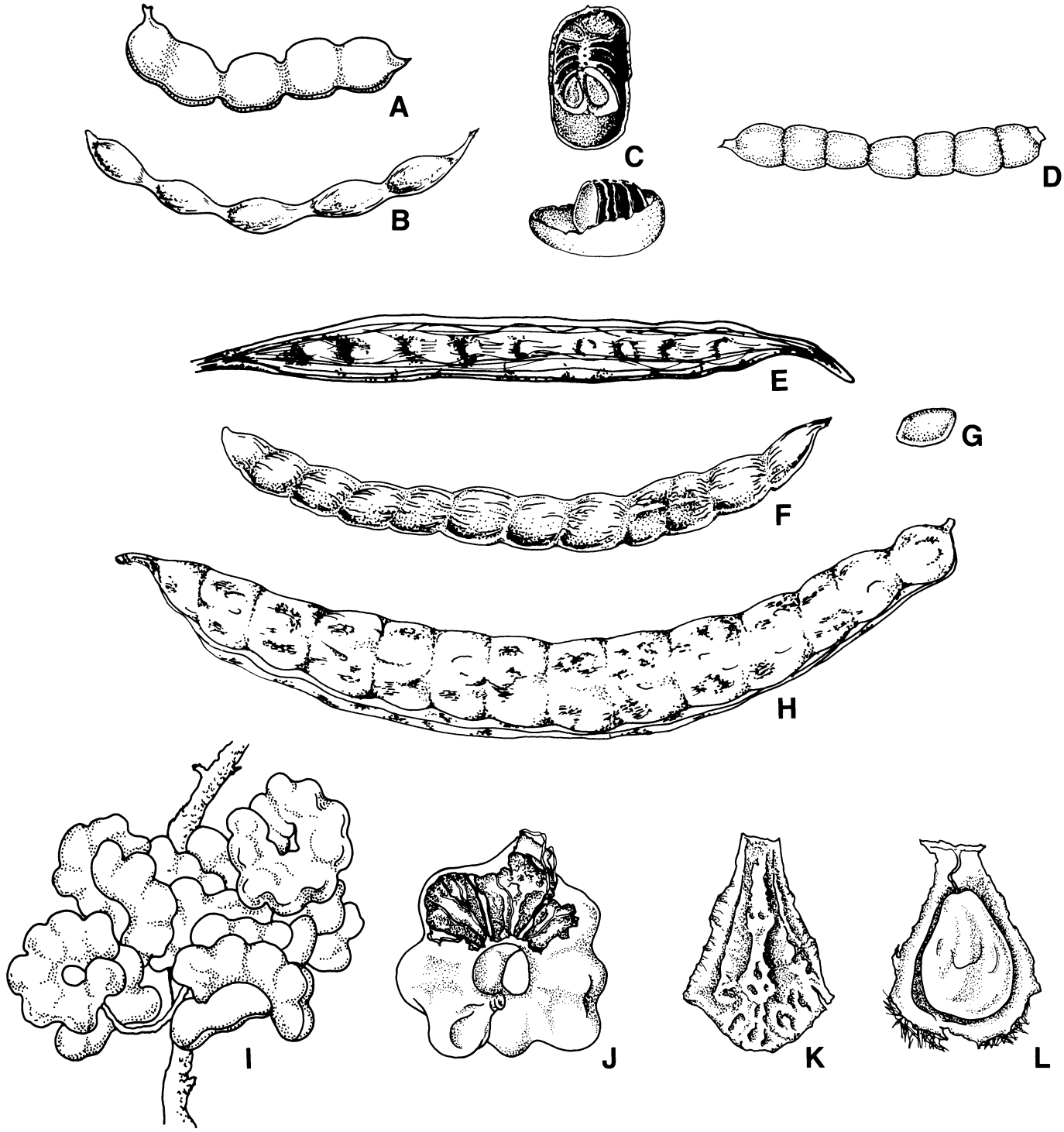
Prosopis fruits (con.): *P. algarobilla* Grisebach (*A*), *P. articulata* S. Watson (*B*), *P. chilensis* (Molina) Stuntz (*F-G*), *P. ferox* Grisebach (*C*), *P. nigra* (Grisebach) Hieronymus (*H*), *P. pallida* (Humboldt & Bonpland ex Willdenow) Kunth (*E*), *P. sericantha* Gillies (*D*), *P. torquata* de Candolle (*I-L*). *A-B, D, F, H,* Fruits (× 1); *C,* opened fruits (× 1); *E,* fruit (× 0.5); *G, K,* endocarp segments (× 1, × 4); *I,* fruit cluster (× 1); *J,* fruit with endocarp in situ (× 1); *L,* seed in situ (× 1).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Genus: *Xerocladia* Harvey.

Phylogenetic Number: 3.16.

Tribe: Mimoseae.

Group: Prosopis.

Species Studied - Species in Genus: 1 sp. - 1 sp.

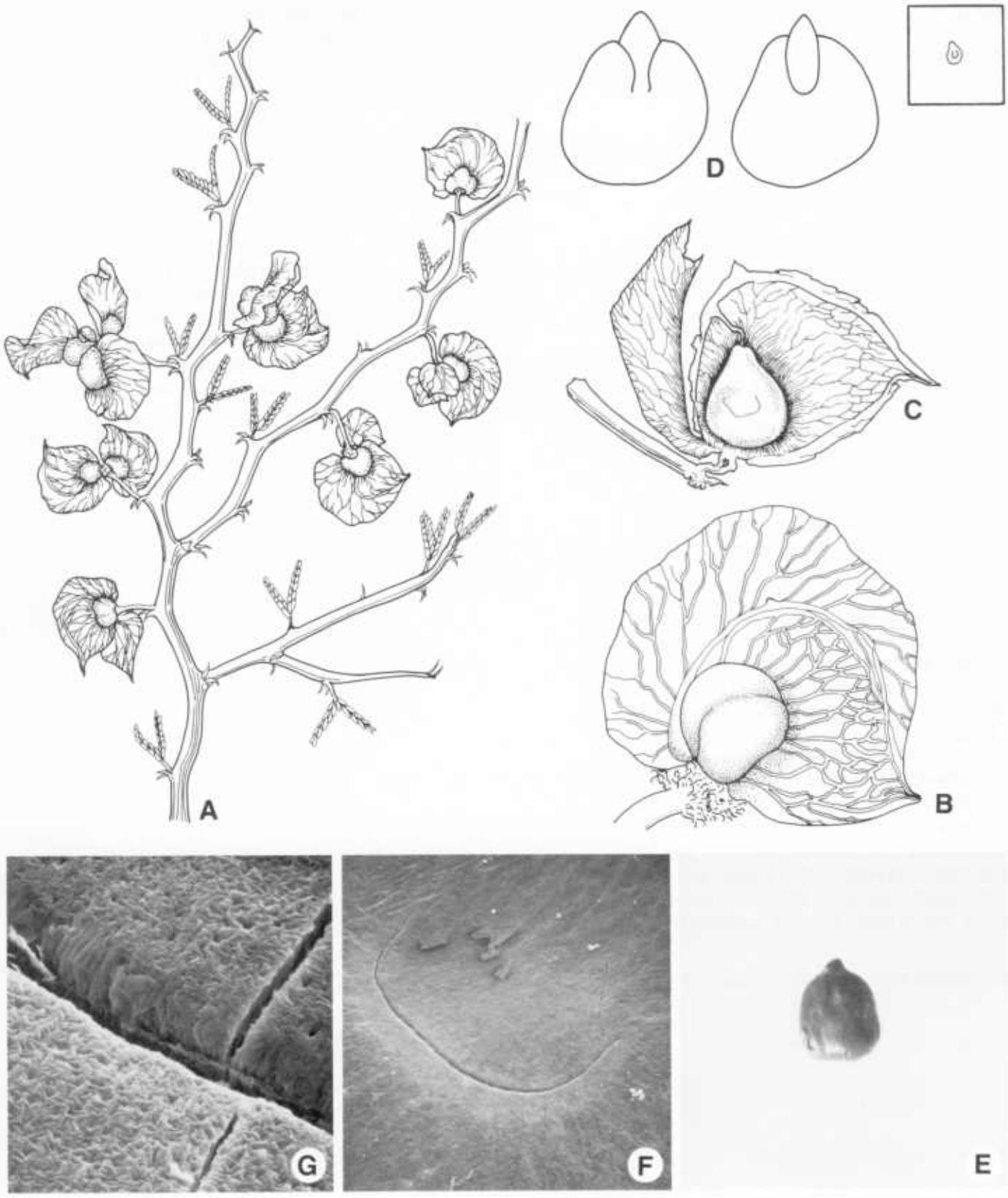
Fruit 1.4-2 × 1-1.5 × 0.4-0.7 cm, curved to ½-coiled, without twists, broadly falcate to ovate or semicircular, margins not constricted, rounded to short tapered to apex, rounded and emarginate to base, nonstipitate, compressed, coriaceous. Valves indehiscent, with dorsal suture arched and winged up to 4 mm wide, bearing prominent spongy tubercle-like structure at base of each face (seed not completely under structure), remaining attached to sutures, without visible seed chambers. Epicarp glossy, shade of brown to purplish brown, minutely pubescent, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, brown to tan, nonseptate. Seed 1, transverse, not overlapping, in 1 series. Funiculus 3 mm long, filiform, hooked to S-shaped.

Seed 6.5-7 × 4.5-5 × 2 mm, ovate, compressed. Testa glossy, brown, smooth, coriaceous, with 50 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, concealed by funicular remnant, flush, apical. Lens 0.3 mm, circular, mound, yellowish. Endosperm absent. Cotyledons auriculate over radicle, concealing only margins of radicle. Embryonic axis straight. Plumule rudimentary.

Distribution: Namibia and Namaqualand.

Notes: More seeds and fruits should be collected and distributed to herbaria.

Xerocladia: X. viridiramis (Burchell) Taubert (*A-G*). *A,* Fruiting branch (× 1); *B,* fruit (× 4); *C,* seed in situ (× 3); *D,* cotyledon not concealing radicle (left) and embryonic axis (right) (× 8); *E-G,* testa (× 4, × 50, × 1,000).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enus: *Prosopidastrum* Burkart.

ıylogenetic Number: 3.17.

·ibe: Mimoseae.

roup: Prosopis.

)ecies Studied - Species in Genus: 2 spp. - 2 spp.

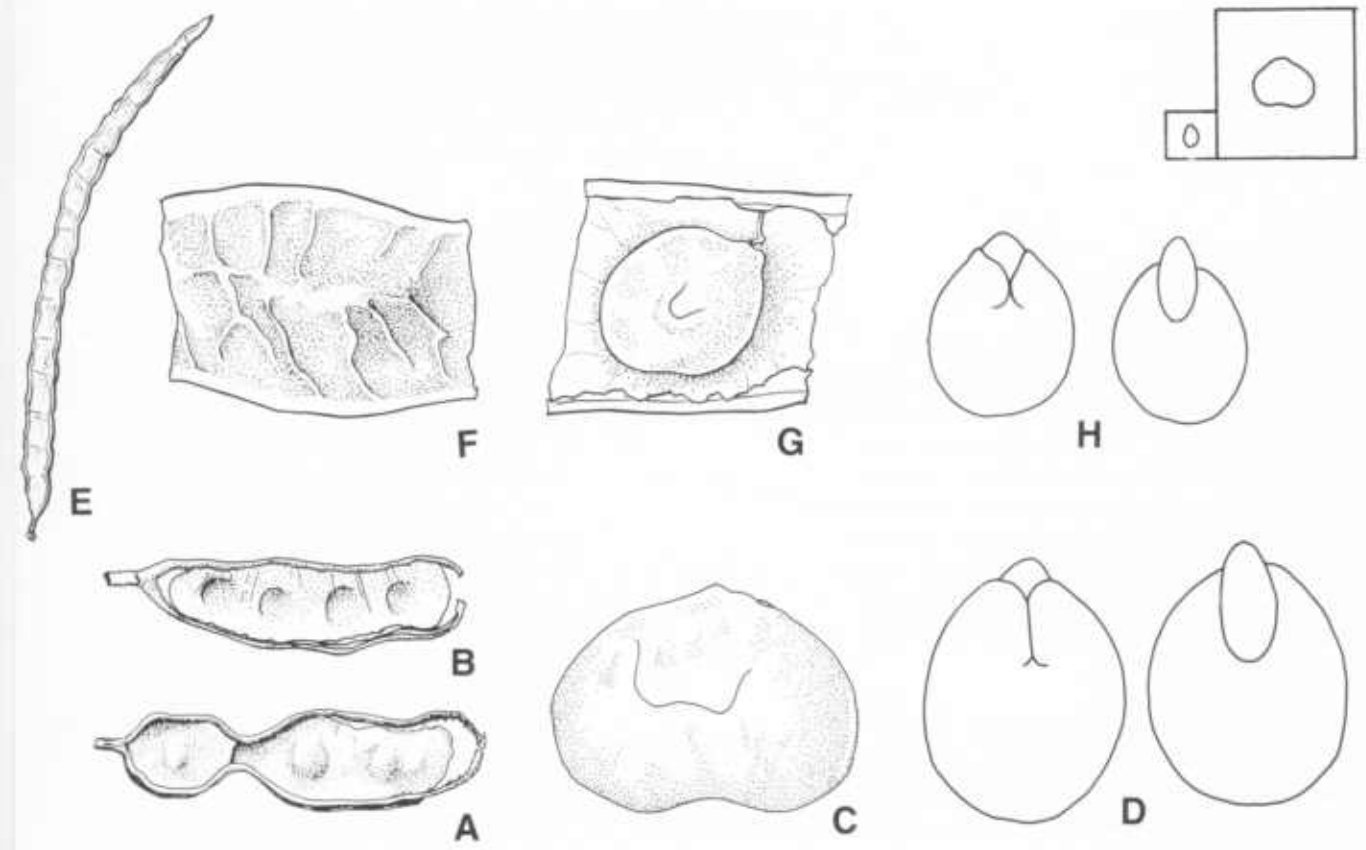
uit 4.5-11.5 × 0.5-1.3 × 0.3 cm, slightly curved, without twists, linear to oblong, margins not constricted to slightly constricted or once constricted, tapered to rounded to apex, short tapered to rounded to base, substipitate, compressed, coriaceous. Valves indehiscent, either entire and separating from replum or segmented through sutures and falling as 1-seeded suture bearing segments, with visible seed chambers. Epicarp dull, reddish brown to brown, glabrous to pubescent, reticulate and with or without transverse lines, not exfoliating. Mesocarp absent. Endocarp dull, ocher, cobwebby within, subseptate. Seeds 3-8, oblique, not overlapping, in 1 series. Funiculus 0.5-3 mm long, filiform, curved to plicate.

ed 3-10 × 2-8 × 1.3-5 mm, ovate to rhombic-ovate or irregular, compressed and umbonate in *P. globosum*. Testa glossy, brown, smooth, coriaceous, with faint 50 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, exposed, flush, apical. Lens 0.3 mm long, oblong to triangular, flush to pit, color of testa to lighter or blackish, often with S-curved or curved discolored line extending ca. 1 mm away from hilum along seed margin (perhaps where funiculus touched testa). Endosperm either disk atop cotyledons or thin and adnate to testa. Cotyledons with basally groined split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule rudimentary.

istribution: Mexico and Argentina (Patagonia).

Notes: Based on fruit and seed characters, *Prosopidastrum* is heterogeneous: The Mexican species, *P. mexicana,* shares only tribal characters with the Patagonian species, *P. globosum.* Dressler (*1956*) named *Prosopis globosa* Gillies var. *mexicana* Dressler without seeing its fruit. He assumed the fruit was a "loment as in the South American variety," *P. globosa* var. *globosa.* When Burkart (*1964*) established *Prosopidastrum,* he elevated var. *mexicana* to a species and described the fruits as "dry, linear, compressed, pericarp subcoriaceous, not at all fleshy, loment, dividing into 1-seeded squarish segments or dehiscing by valves, valves separating from persistent replum. Seeds with copious endosperm." These fruit differences apparently did not concern Burkart. More seeds and fruits should be collected and distributed to herbaria.

Prosopidastrum: P. globosum (Gillies) Burkart (*E-H*), *P. mexicana* (Dressler) Burkart (*A-D, J-K*), *P.* spp. (*I*). *A, B, E,* Fruits (× 1); *C,* seed topography (× 6); *D, H,* cotyledons concealing all but radicle tip (left) and embryonic axis (right) (× 6); *F,* fruit segment (× 1); *G,* seed in situ (× 6); *I-K,* testa (× 3, × 50, × 1,000).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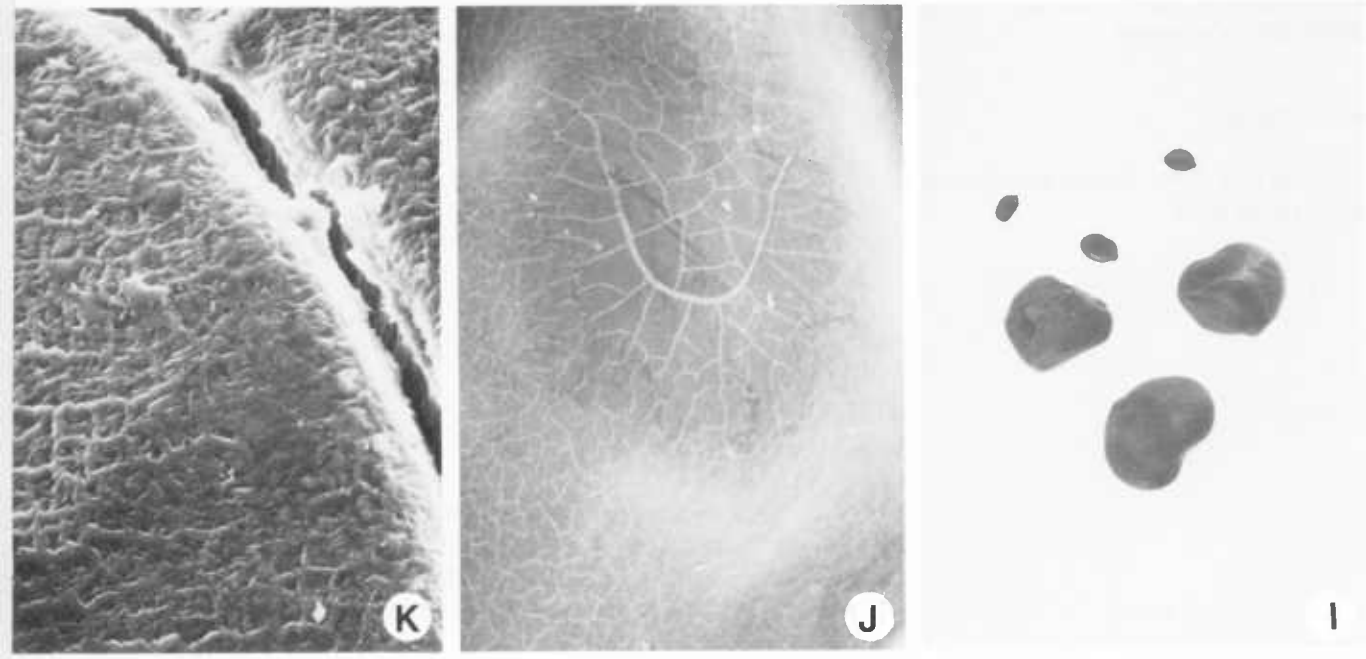
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Genus: *Piptadeniopsis* Burkart.

Phylogenetic Number: 3.18.

Tribe: Mimoseae.

Group: Prosopis.

Species Studied - Species in Genus: 1 sp. - 1 sp.

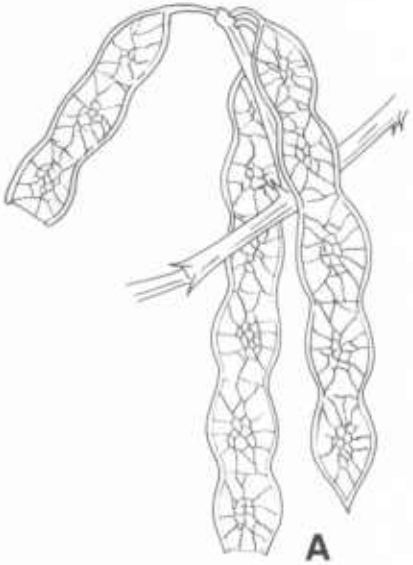
Fruit 8-9 × 0.8-1.1 × 0.1-0.2 cm, curved, without twists, linear, constricted, short tapered to rounded to apex, short tapered to stipe up to 10 mm long, compressed, coriaceous. Valves indehiscent, segmented and separating transversely into 1-seeded segments, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown, glabrous, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, ocher, nonseptate. Seeds 3-9, parallel, not overlapping, in 1 series. Funiculus to 10 mm long, filiform, curved.

Seed 7 × 6 × 1.5-2 mm, ovate, compressed. Testa glossy, brown, smooth, chartaceous, without pleurogram or fracture lines or wing (winglike rim present along margin of seed) or aril. Hilum punctiform, concealed by funicular remnant, flush, subapical. Lens 0.3-0.4 mm long, linear, flush, yellowish. Endosperm absent. Cotyledons with simple split or auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: Paraguay.

Notes: More seeds and fruits should be collected and distributed to herbaria.

Piptadeniopsis: P. lomentifera Burkart (*A-F*). *A*, Fruit cluster (× 1); *B*, seed in situ (× 7); *C*, cotyledons concealing all but radicle tip (left) and embryonic axis (right) (× 4); *D-F*, testa (× 3, × 50, ×1,000).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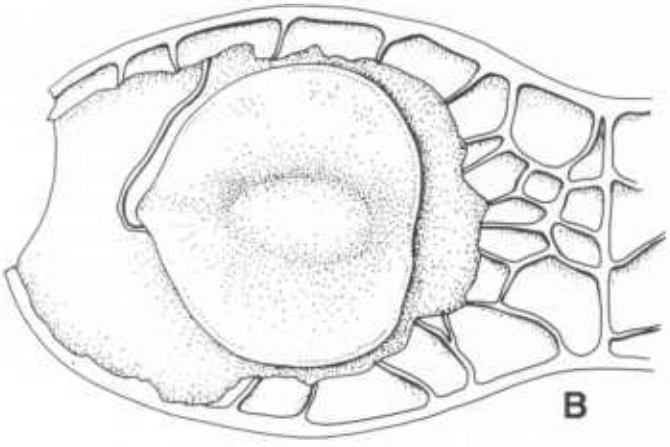
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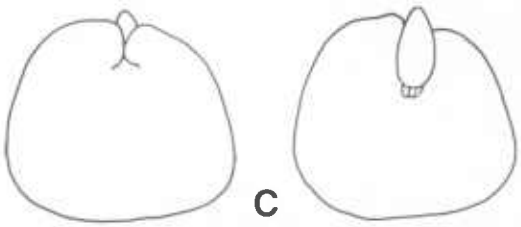
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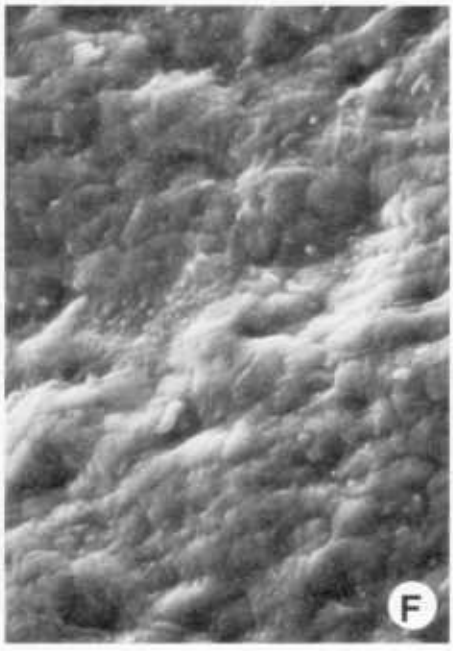
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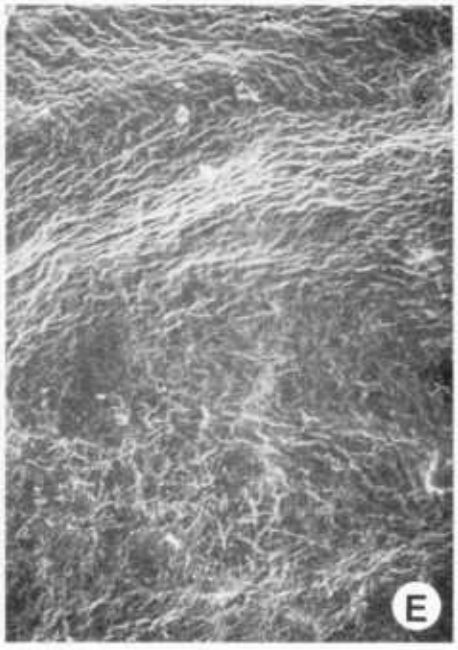
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Genus: *Stryphnodendron* Martius.

Phylogentic Number: 3.19.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 6 spp. - ca. 20 spp.

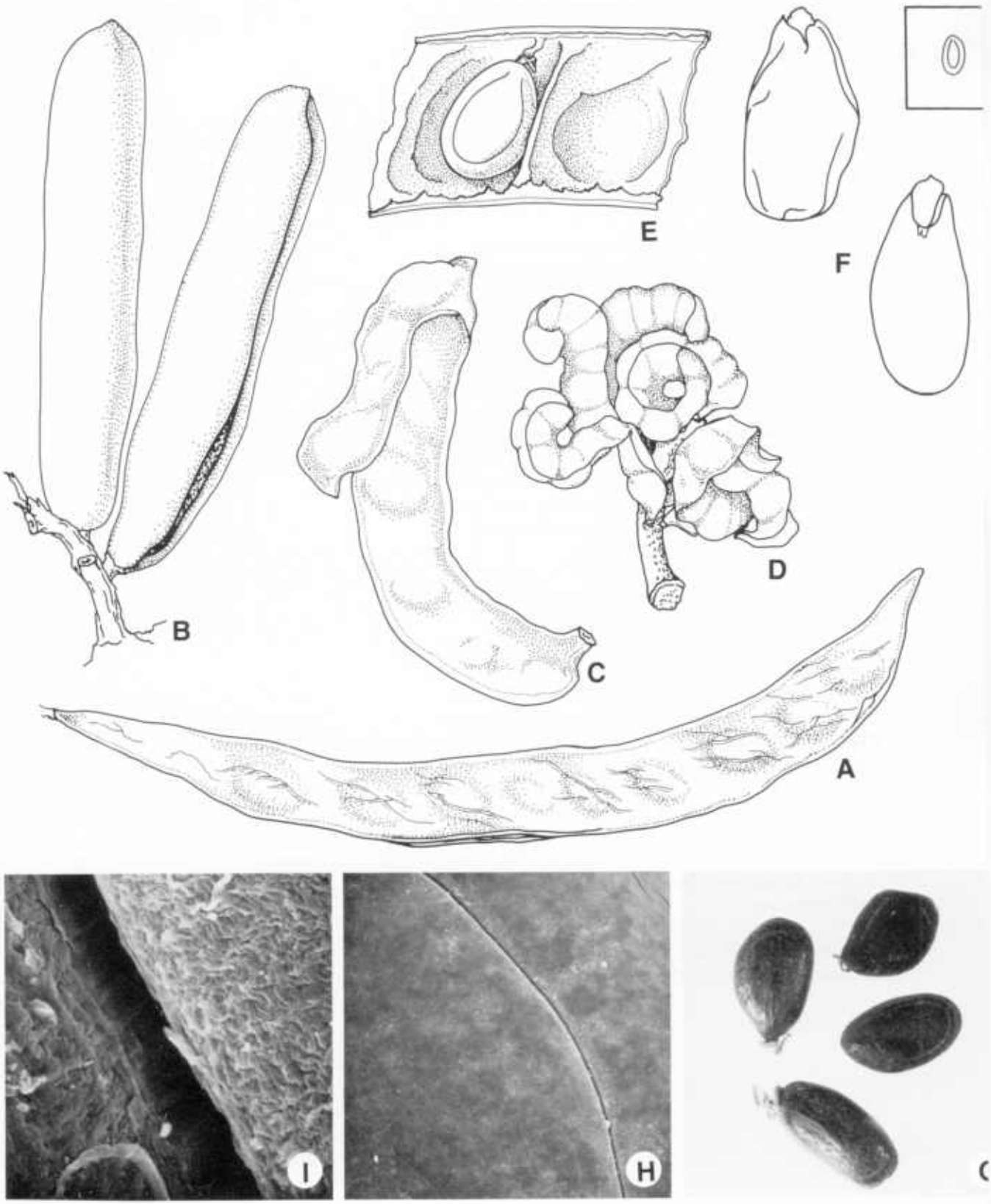
Fruit 4-30 × 0.8-2.5 × 0.1-1 cm, ½-coiled to straight, without twists, linear to broadly linear, margins not constricted or dorsal margin slightly constricted, rounded to tapered to apex, rounded to long tapered to base, substipitate to nonstipitate, compressed to flattened, subligneous. Valves indehiscent to tardily medially dehiscent, remaining attached to sutures, with or without visible seed chambers. Epicarp dull, brown to black, tomentose to becoming glabrate or glabrous with age, shagreen and rugose, not exfoliating. Mesocarp either present and pulpy to fleshy when fresh and drying to vitriol or solid or absent. Endocarp dull, brown, septate. Seeds 10-14, oblique to transverse, not overlapping, in 1 series. Funiculus up to 4 mm long, thick to filiform, plicate.

Seed 5-10 × 4-6 × 3 mm, ovate to elliptic, compressed. Testa dull to glossy, blackish to brown, shagreen to smooth, with linear mound arising near hilum crossing pleurogram terminating in faint umbo, with 90 percent pleurogram, with or without fracture lines, without wing and aril. Hilum punctiform, concealed by funicular remnant, raised, subapical. Lens either not discernible or discernible and up to 0.3 mm long, circular, pit, tan. Endosperm thick, encasing embryo. Cotyledons with simple split over radicle, concealing all but tip of radicle, somewhat folded. Embryonic axis straight. Plumule rudimentary.

Distribution: Tropical America.

Notes: Occhioni Martins (*1974, 1975*) and Occhioni Martins and Martins (*1972*) have studied this genus.

Stryphnodendron: S. barbadetimam (Vellozo) Occhioni Martins (*B, H-I*), *S. coriaceum* Bentham (*C*), *S. goyazense* Taubert (*E*), *S. guianense* (Aublet) Bentham (*A, F*), *S. polystachyum* (Miquel) Kleinhoonte (*D*), *S.* spp. (*G*). *A, C,* Fruits (× 1); *B, D,* fruit clusters (× 1); *E,* seed in situ (× 3); *F,* cotyledon concealing all but tip of radicle (upper) and embryonic axis (lower) (× 4); *G-I,* testa (× 3, × 50, × 1,000).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Genus: *Goldmania* Rose ex Micheli.

Phylogenetic Number: 3.20.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 2 spp. - 2 spp.

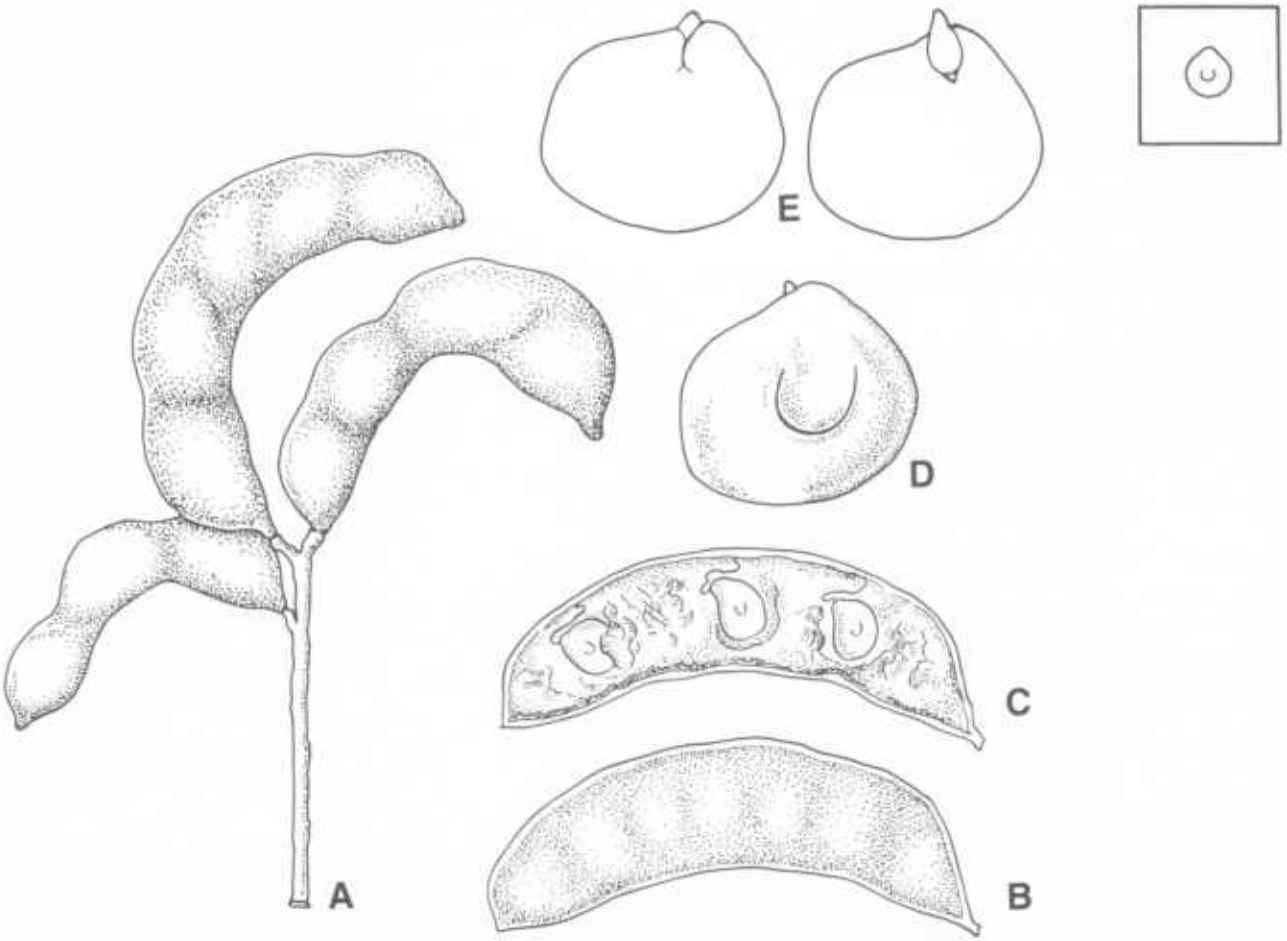
Fruit 2-10 × 1-1.5 ×0.5-0.7 cm, curved to ½-coiled, without twists, linear, margins slightly constricted to occasionally once constricted, short tapered to apex, tapered to stipe up to 8 mm long or substipitate, compressed, subligneous. Valves dehiscing apically along dorsal margin, remaining attached to sutures, with visible seed chamber. Epicarp dull, reddish brown, pubescent, shagreen and faintly venose, not exfoliating. Mesocarp solid, subligneous. Endocarp dull, reddish brown, scurfy and exfoliating, subseptate to nonseptate. Seeds 3-8, parallel to oblique, not overlapping, in 1 series. Funiculus 6-8 mm long, thick, S-curved to plicate.

Seed 5.5-9 × 5.5-8 × 2-3 mm, circular to ovate or irregular, compressed. Testa dull, white to tan, smooth, osseous to coriaceous, with 50 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, concealed by funicular remnant, flush, subapical. Lens 0.5 mm long, elliptic to rhombic, mound to flush, darker to lighter or color of testa. Endosperm thin, encasing embryo. Cotyledons auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight to slightly deflexed. Plumule rudimentary.

Distribution: Mexico and Central America, and Paraguay and Argentina.

Notes: The two species have similar seed and fruit characters but divisive distributions.

Goldmania: G. paraguayensis (Bentham) Brenan (*B-C*), *G. platycarpa* Rose ex Micheli (*A, D-H*). *A,* Fruit cluster (× 1); *B,* fruit (× 1.5); *C,* seeds in situ (× 1.5); *D,* seed topography (× 4); *E,* cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 4); *F-H,* testa (× 3, × 50, × 1,000).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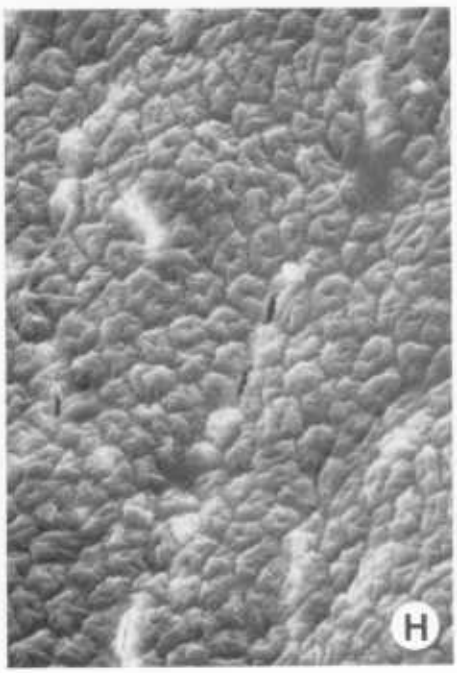
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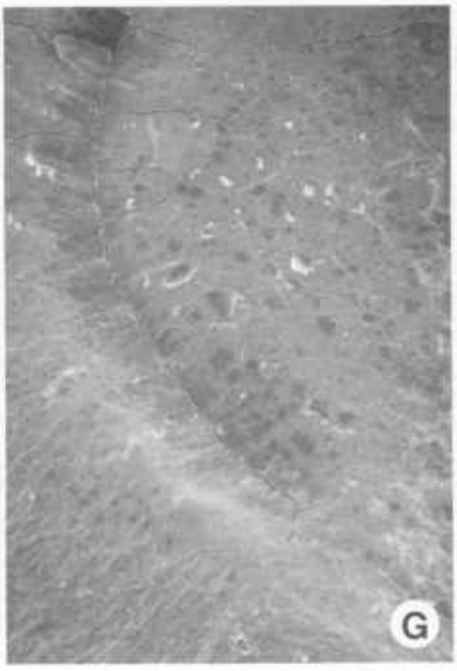
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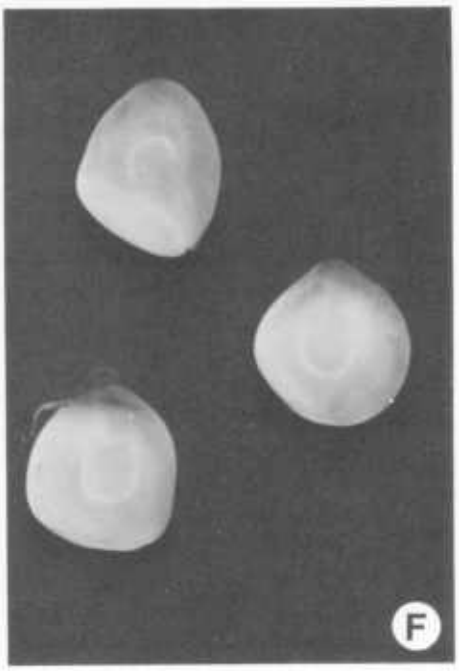
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Genus: *Piptadenia* Bentham.

Phylogenetic Number: 3.21.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 13 spp. - ca. 15 spp.

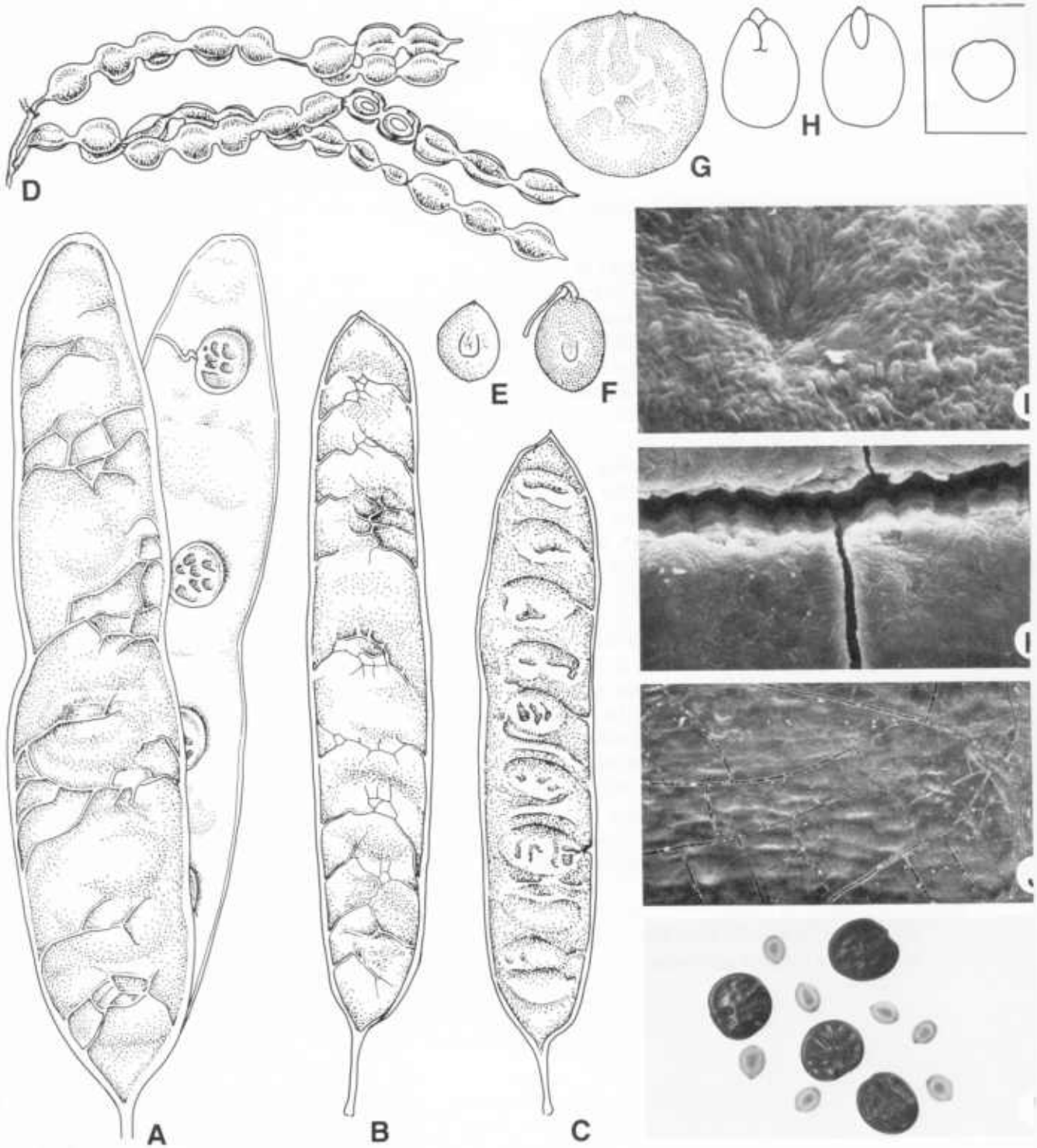
Fruit 6-18 × 0.7-4 × 0.3-0.8 cm, straight to slightly curved, usually undulate and without twists, oblong to linear or moniliform, margins not constricted to either one or both constricted, rounded to apex, tapered to stipe 10-15 mm long, flattened to compressed, chartaceous to coriaceous. Valves dehiscing apically either along both margins or along ventral margin (*P. obliqua*), remaining attached to sutures, with or without visible seed chambers. Epicarp dull, brown to grayish brown, glabrous, either minutely pitted or not or shagreen and with scaly surface on moniliform fruits, not exfoliating. Mesocarp absent. Endocarp glossy to dull, tan, nonseptate to septate. Seeds 3-12, transverse, not overlapping, in 1 series. Funiculus up to 7 mm long, thick, plicate.

Seed 6-20 × 4-15 × 1-3 mm, elliptic to subcircular, compressed. Testa dull to glossy, tan to blackish brown or black, smooth to rugose, osseous to chartaceous, with or without 75 percent pleurogram and fracture lines, without wing and aril. Hilum punctiform, exposed, flush, apical. Lens 0.2-0.5 mm long, linear to elliptic, flush to nearly so, tan. Endosperm either absent or present and thick, adnate to testa. Cotyledons either auriculate over radicle and concealing all but tip of radicle or notched and exposing radicle, rugose. Embryonic axis straight. Plumule well developed to rudimentary.

Distribution: Tropical South America and southern Central America.

Notes: *Piptadenia* has two distinct fruit types, moniliform and oblong to linear, and two distinct seed types. Seeds are either pleurogrammatic, smooth, and endospermic or nonpleurogrammatic, rugose, and nonendospermic. Bravato (*1974*) opined that there may be more than one section in this genus. The illustrated and studied species may represent more than one genus. A monograph is needed.

Piptadenia: P. communis Bentham (*C*), *P. constricta* (Micheli & Rose) Macbride (*D-E, H, J-K*), *P. latifolia* Bentham (*B*), *P. obliqua* (Persoon) Macbride (*F*), *P. paniculata* Bentham (*A, G, L*), *P.* spp. (*I*). *A*, Dehiscent fruit (× 1); *B-C*, fruits (× 1); *D*, dehiscent fruit cluster (× 1); *E-G*, seed topography (× 3); *H*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 3); *I-L*, testa (× 1, × 50, × 1,000, × 1,000).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Genus: *Pseudoentada* Britton & Rose.

Phylogenetic Number: 3.22.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 3 spp. - ca. 6 spp.

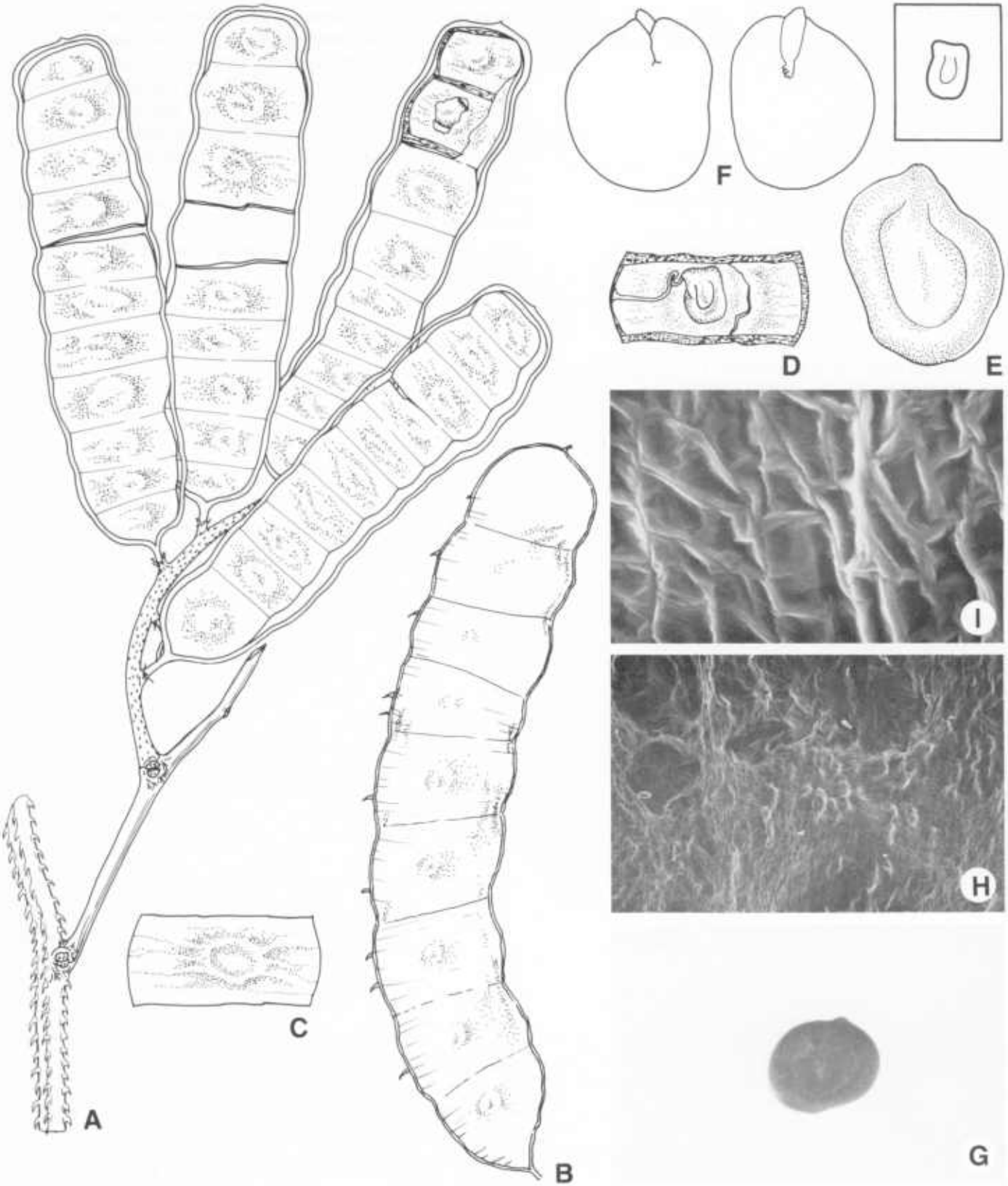
Fruit 8-13 × 2-3 × 0.2-0.3 cm, straight to curved, without twists, oblong, margins slightly constricted and without or with prickles, rounded to apex, rounded to stipe 5-7 mm long, flattened, coriaceous. Valves indehiscent, segmented and separating transversely into 1-seeded wing segments falling free from replum, with or without visible seed chambers. Epicarp dull, greenish tan to reddish tan, glabrous, reticulate, exfoliating. Mesocarp absent. Endocarp dull, brown (darker in seed chamber), separating into segments and from exocarp and sutures, septate. Seeds 12-14, oblique, not overlapping, in 1 series. Funiculus to 10 mm long, filiform, plicate.

Seed 7 × 5.5 × 1.5 mm, oblong, compressed. Testa glossy, brown, smooth, coriaceous, with 90 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, concealed by funicular remnant, flush, subapical. Lens not discernible. Endosperm thin, adnate to testa. Cotyledons auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule rudimentary.

Distribution: Central America and tropical Africa.

Notes: According to Lewis (pers. commun., 1982), a new, yet to be named, Mexican species will increase to seven the number of species.

Pseudoentada: P. patens (Hooker & Arnott) Britton & Rose (*A, C-I*), *P. spicata* (E. Meyer) Brenan (*B*). *A*, Fruit cluster (× 1); *B*, fruit (× 1); *C*, 1-seeded endocarp segment (× 2); *D*, seed in situ (× 2); *E*, seed topography (× 4); *F*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 4); *G-I*, testa (× 1, × 50, × 1,000).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:nus: *Newtonia* (American).

ylogenetic Number: 3.23.

ibe: Mimoseae.

oup: Piptadenia.

ecies Studied - Species in Genus: 4 spp. - 5-(7) spp.

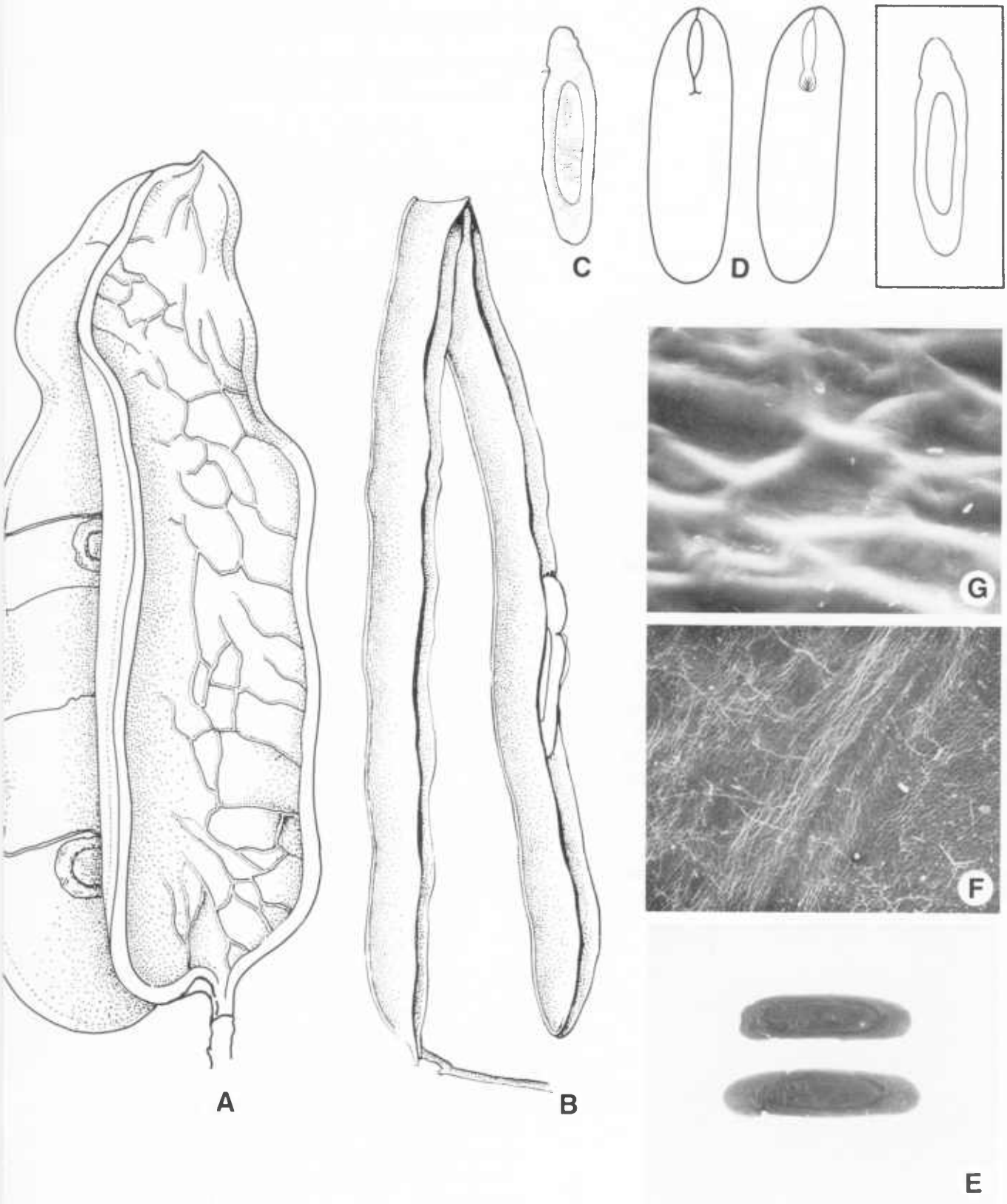
uit 15-55 × 1-6 × 0.3-0.8 cm, straight to curved, without twists, linear to oblong, margins not constricted to slightly constricted, tapered to rounded to apex, short tapered to stipe up to 20 mm long, compressed to flattened, coriaceous to subligneous. Valves dehiscing medially along ventral suture, remaining attached to sutures, without visible seed chambers. Epicarp glossy to dull, dark brown to brown, glabrous, without or with prominent reticulation, not exfoliating. Mesocarp solid, coriaceous to subligneous. Endocarp dull, brown, nonseptate. Seeds 4-9, transverse to parallel, not overlapping, in 1 series. Funiculus to 20 mm long, filiform, nearly straight.

ed 20-30 × 9-10 × 0.1 mm, oblong, flattened. Testa dull, blackish brown, smooth to rugose especially over cotyledons, chartaceous, with wing 3 mm wide, without pleurogram or fracture lines or aril. Hilum punctiform, occluded by wing, flush, marginal. Lens not discernible. Endosperm absent. Cotyledons notched exposing radicle. Embryonic axis straight. Plumule well developed.

stribution: Tropical America.

Notes: Burkart (*1979*) split *Newtonia* s.l. into two sections: Newtonia of Africa (now *Newtonia* s.s., 3.06) and Neonewtonia of South America. Lewis and Elias (*1981*) regarded section Neonewtonia as a segregate genus but gave it no formal name. Fruit and seed characters do not support segregating American species from African species and placing them in different phylogenetic groups. Although fruits and seeds exhibit unifying characters, flowers and pollen exhibit divisive characters. From a fruit standpoint, *N. glaziovii* of South America is unlike the other studied species.

Newtonia (American): *N. glaziovii* (Harms) Burkart (*A*), *N. suaveolens* (Miquel) Brenan (*B-G*). *A-B*, Dehiscent fruits (× 1); *C*, seed topography (× 1); *D*, cotyledon not concealing radicle (left) and embryonic axis (right) (× 2.5); *E-G*, testa (× 1, × 50, × 1,000).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Genus: *Parapiptadenia* Brenan.

Phylogenetic Number: 3.24.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 3 spp. - 3 spp.

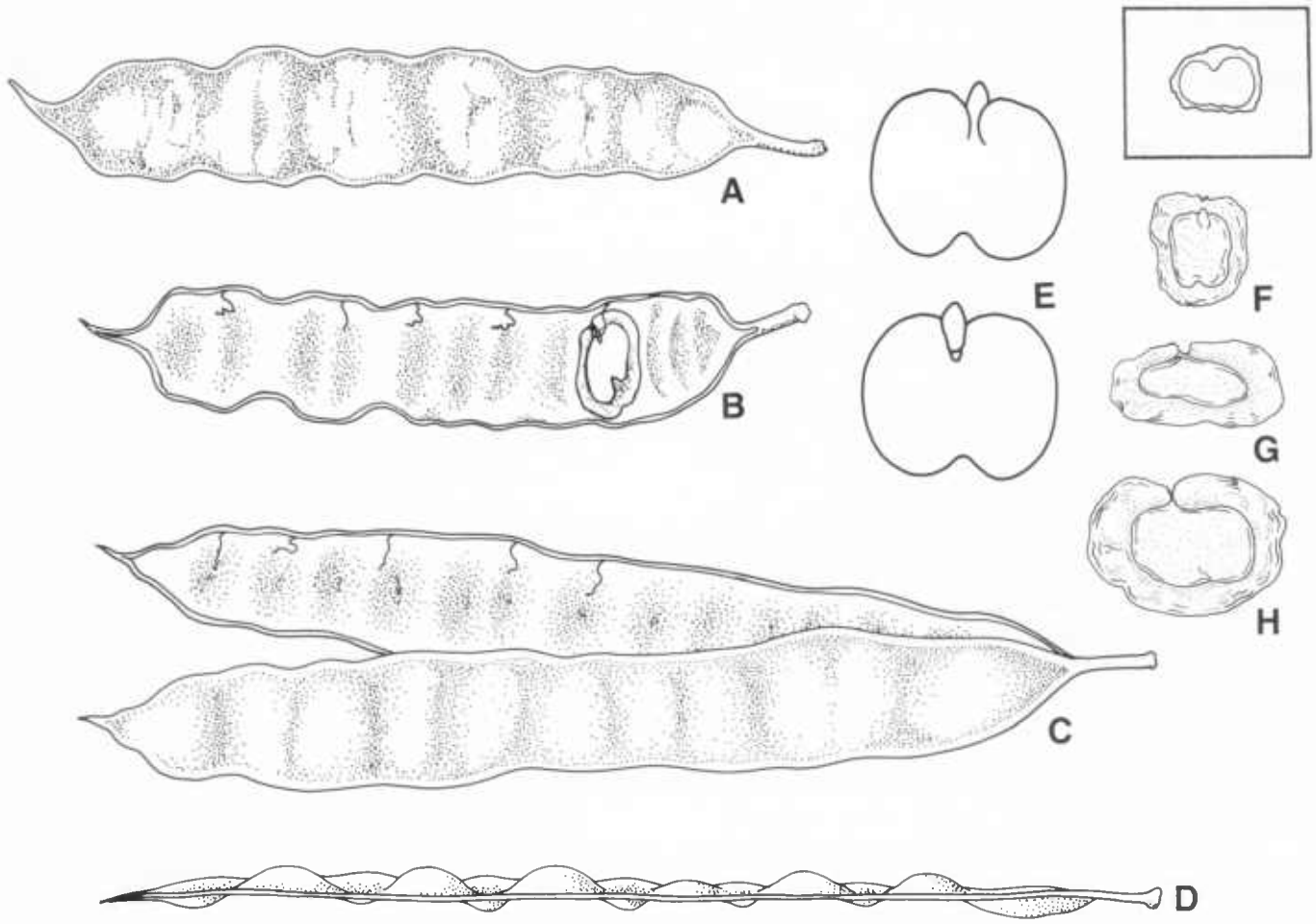
Fruit 10-15 × 1-3 × 0.2-0.4 cm, straight to slightly curved, without twists, broadly linear, margins irregularly slightly constricted to constricted, tapered to rounded to apex, tapered to short tapered to stipe up to 16 mm long or nonstipitate, flattened, subcoriaceous. Valves dehiscing apically and medially along both margins, remaining attached to sutures, with visible seed chamber. Epicarp dull, reddish brown to brown, glabrous, faintly venose, not exfoliating. Mesocarp absent. Endocarp dull, tan and slightly to prominently brown in seed chambers or not, nonseptate though valve somewhat pleated and tan between seeds. Seeds 7-11, transverse, not overlapping, in 1 series. Funiculus 3-5 mm long, filiform, S-curved.

Seed 10-16 × 7-13 × 0.1 mm, irregularly elliptic to oblong, flattened. Testa glossy, medium to dark brown, smooth to rugose and pitted on wing, chartaceous, with often erose wing not exceeding 6 mm in width, without pleurogram or fracture lines or aril. Hilum punctiform, occluded by wing, flush, apical according to embryonic axis and marginal according to seed length of some species. Lens not discernible. Endosperm thin, encasing embryo. Cotyledons notched exposing radicle. Embryonic axis straight and at right angles to seed length in 2 species and parallel to seed length in 3rd species. Plumule rudimentary.

Distribution: Tropical South America.

Notes: This is the only mimosoid genus that has at least one species with basally notched cotyledons.

Parapiptadenia: P. blanchetii (Bentham) Brenan (*G*), *P. pterosperma* (Bentham) Brenan (*H*), *P. rigida* (Bentham) Brenan (*A-F, I-J*). *A*, Fruit (× 1); *B*, seed in situ (× 1); *C*, dehiscent fruit (× 1); *D*, fruit in suture view (× 1); *E*, cotyledons not concealing radicle (upper) and embryonic axis (lower) (× 3); *F-H*, seed topography (× 1); *I-J*, testa (× 2, × 50).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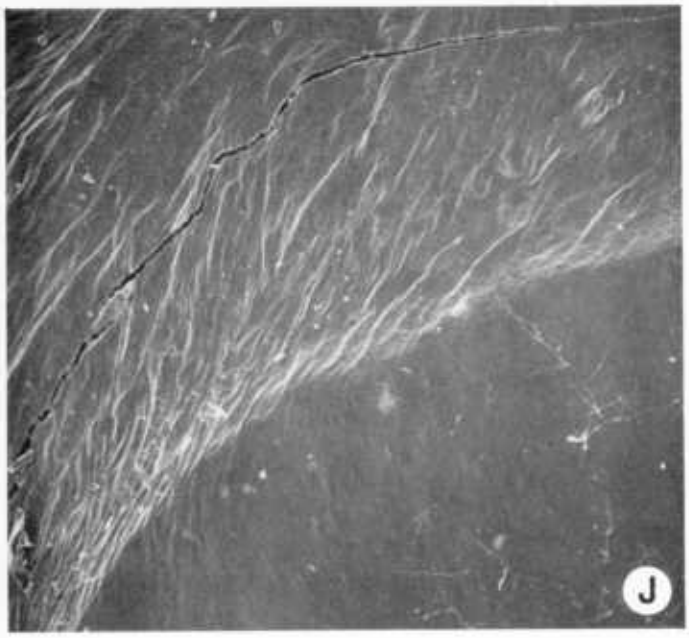
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I

Genus: *Monoschisma* Brenan.

Phylogenetic Number: 3.25.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 1 sp. - ca. 3 spp.

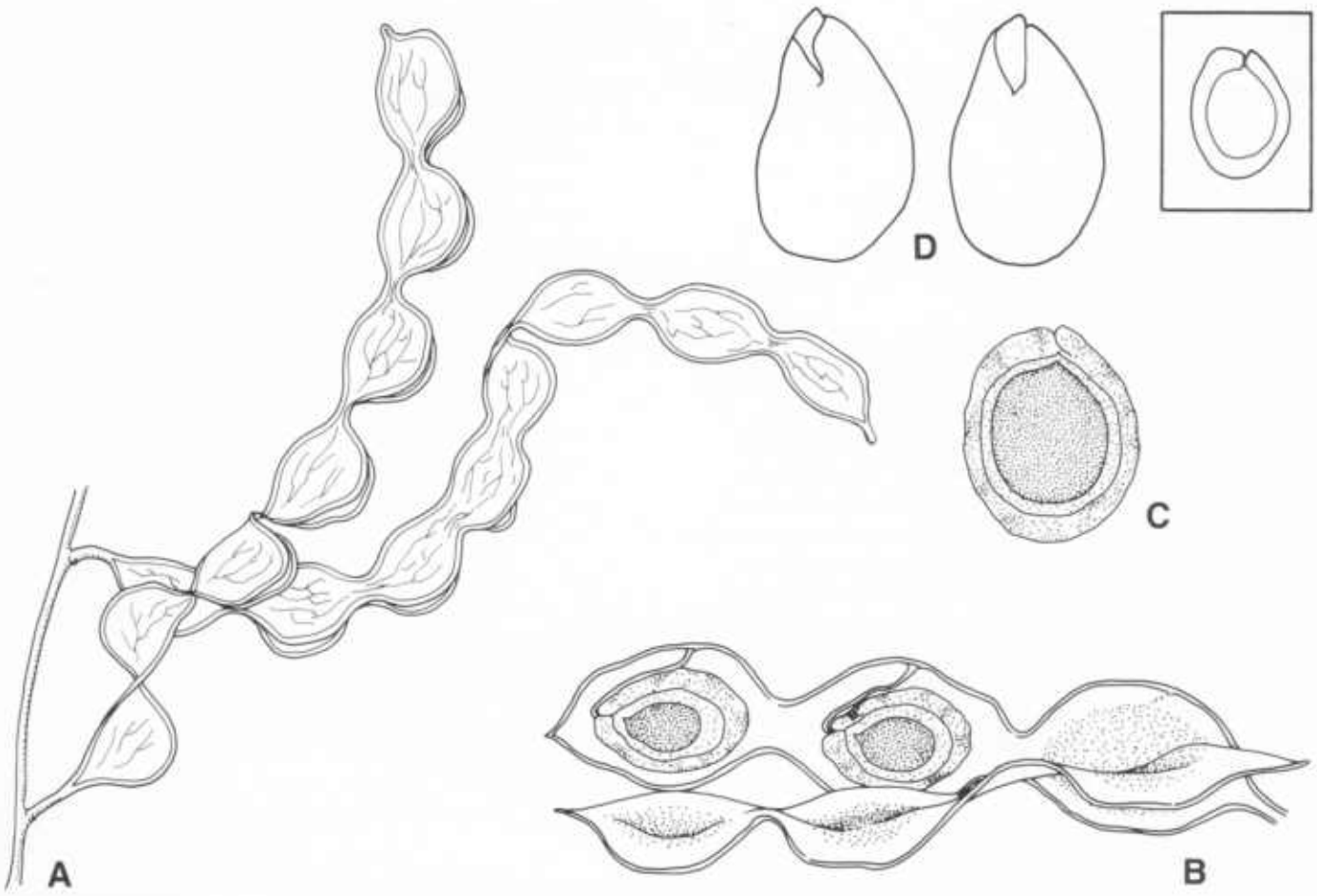
Fruit 8-17 × 1-1.5 × 0.2 cm, straight to curved, with or without twists, linear or moniliform, margins constricted or ventral margin constricted and dorsal slightly constricted, short tapered to apex, short tapered to stipe 5-9 mm long, flattened, coriaceous. Valves dehiscing medially along ventral margin and reflexing in concert or independently, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown, glabrous to scaly, faintly reticulate, not exfoliating. Mesocarp absent. Endocarp dull, reddish brown to brown, nonseptate but constricted between seeds. Seeds 4-14, parallel, not overlapping, in 1 series. Funiculus 7-8 mm long, filiform, S-curved to plicate.

Seed 9-11 × 6-7 × 0.1 mm, subcircular to short elliptic, flattened. Testa glossy, brown, faintly striate to striate, chartaceous (nearly transparent, embryo clearly visible within), with wing 1-1.5 mm wide, without pleurogram or fracture lines or aril. Hilum punctiform, occluded by wing, flush, apical to subapical or occasionally marginal in relationship to embryonic axis. Lens not discernible. Endosperm absent. Cotyledons auriculate over radicle, concealing margins of radicle. Embryonic axis straight to deflexed or occasionally at right angles to hilum. Plumule rudimentary.

Distribution: South America.

Notes: The seed characters of this segregate genus of *Piptadenia* clearly separate *Monoschisma* from *Piptadenia*. The number of species in this genus came from Lewis (pers. commun., 1982) and not from Lewis and Elias (*1981*).

Monoschisma: M. leptostachya (Bentham) Brenan (*A-F*). *A*, Fruits (× 1); *B*, seeds in situ (× 2); *C*, seed topography (× 3); *D*, cotyledons partially concealing radicle (left) and embryonic axis (right) (× 3); *E-F*, testa (× 1, × 50).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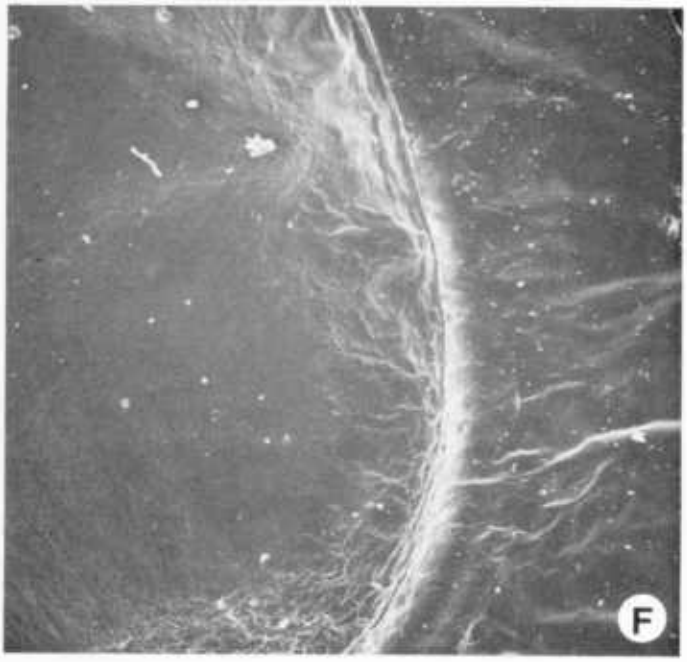
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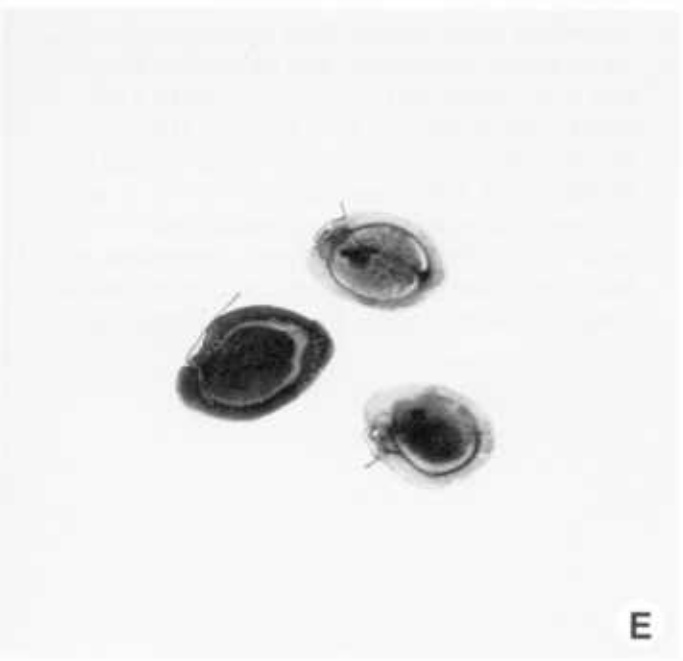
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Genus: *Anadenanthera* Spegazzini.

Phylogenetic Number: 3.26.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 2 spp. - 2 spp.

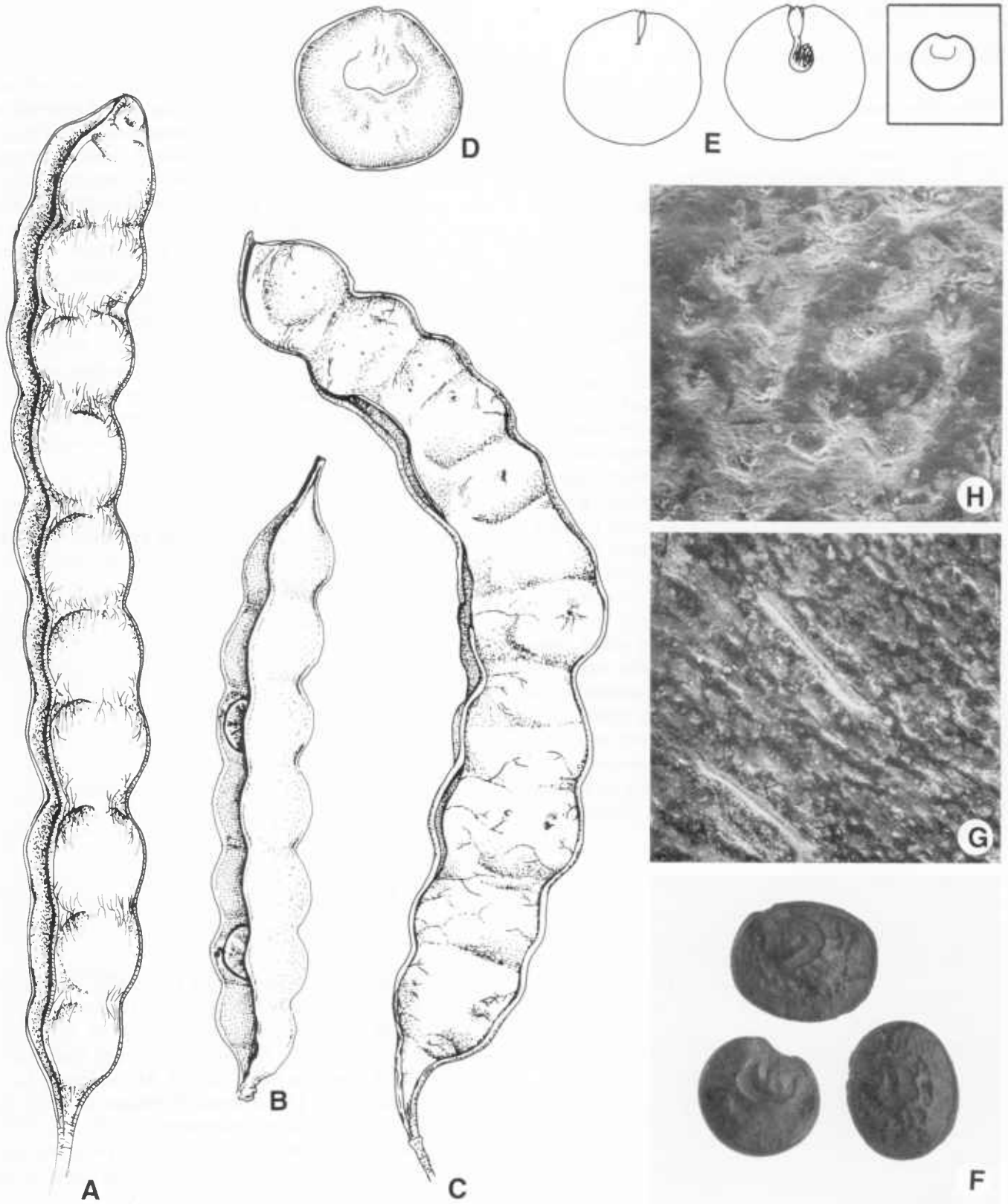
Fruit 5-35 × 1-3 × 0.4-0.5 cm, straight to falcate, without twists, oblong, margins not constricted to constricted, short tapered to rounded to apex, tapered to stipe 5-50 mm long, flattened, subligneous. Valves dehiscing medially by ventral suture, remaining attached to sutures, with visible (based on margins) seed chambers. Epicarp dull to glossy, either monochrome reddish brown to brown or mottled gray brown dotted with reddish brown, covered with minute reddish scale, thus scurfy to verrucose, rugose to smooth or reticulate, not exfoliating. Mesocarp solid, subligneous. Endocarp dull, brown to reddish brown, subseptate. Seeds 4-13, transverse, not overlapping, in 1 series. Funiculus up to 4 mm long, filiform, plicate.

Seed 8-25 × 8-20 × 2 mm, subcircular to elliptic, flattened. Testa glossy, dark brown to black, faintly striate, occasionally rugose and/or pitted, relatively smooth for about 0.5 mm within pleurogram, with or without linear mound from hilum to about center of areola, coriaceous, with or without 50 percent pleurogram, and winglike rim (up to 2 mm wide), without fracture lines and aril. Hilum punctiform, concealed by funicular remnant, flush but in depression, apical according to embryonic axis and marginal according to seed length. Lens 0.3 mm long, elliptic, flush, tan to brown. Endosperm absent. Cotyledons notched exposing most of radicle. Embryonic axis straight. Plumule well developed.

Distribution: West Indies and northern South America.

Notes: This segregate genus of *Piptadenia* contains the two species named here as well as *P. macrocarpa* Bentham and *P. cebil* Grisebach, both now varieties of *A. colubrina*. Von Reis Altschul (*1964, 1972*) described fruits as "falsely septate." *Anadenanthera peregrina* seeds are pleurogrammatic and without winglike rim, and *A. columbrina* seeds are nonpleurogrammatic and bear a winglike rim.

Anadenanthera: A. colubrina (Vellozo) Brenan (*C*), *A. peregrina* (Linnaeus) Spegazzini (*A-B, D-H*). *A, C,* Dehiscent fruits (× 1); *B*, partial seeds in situ (× 1); *D*, testa topography (× 2); *E*, cotyledon not concealing radicle (left) and embryonic axis (right) (× 2); *F-H*, testa (× 2, × 50, × 1,000).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Genus: *Mimosa* Linnaeus.

Phylogenetic Number: 3.27.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 60 spp. - ca. 400-450 spp.

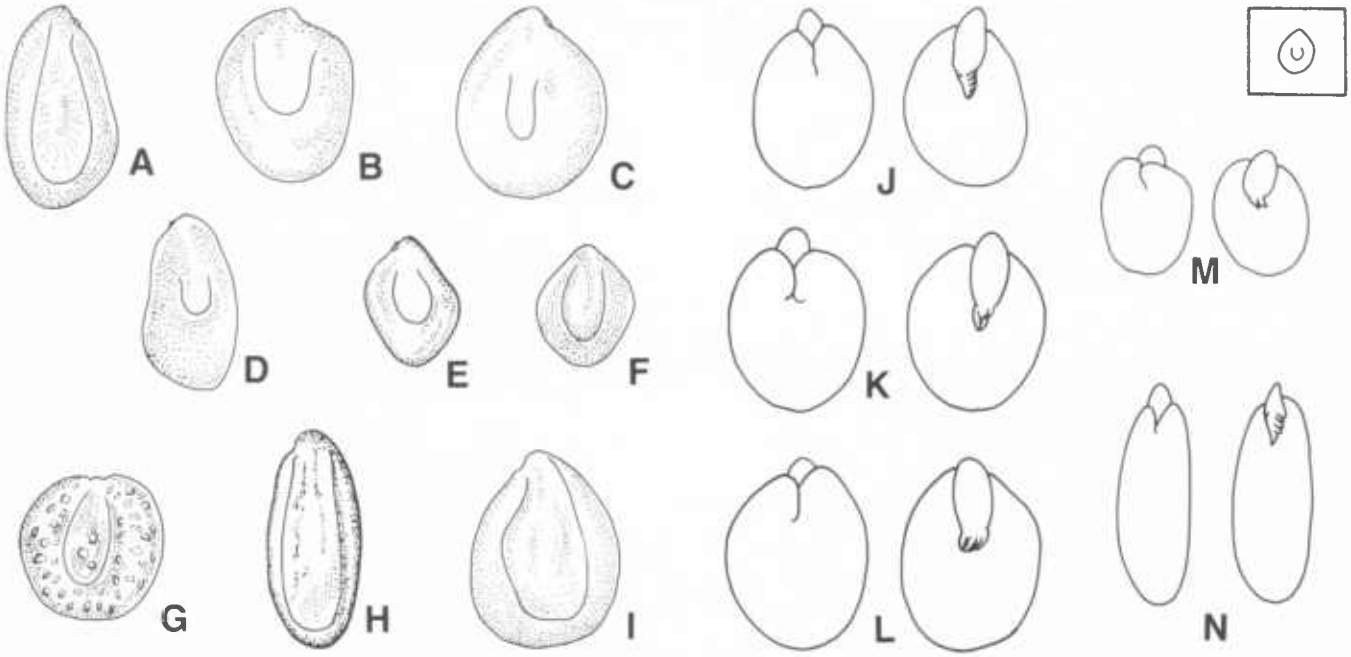
Fruit 1-23 × 0.2-3 × 0.1-0.5 cm, straight to several-coiled, with or without twists, oblong to obovate or linear, margins not constricted to slightly constricted or constricted and occasionally with wing-like incised fringe or prickles, with or without bristles or prickles, tapered to rounded to apex, short tapered to rounded to stipe up to 30 mm long or substipitate or rarely nonstipitate, compressed to flattened, coriaceous to chartaceous. Valves (1) dehiscing medially and remaining attached to sutures, or (2) separating from 1 suture or falling from replum, or (3) segmented and separating transversely into 1-seeded indehiscent segments falling free of replum, with visible seed chambers. Epicarp dull to glossy, brown to various shades and in combination with other colors, glabrous to pubescent or prickly (including stellate hairs and/or prickles), eglandular to glandular, reticulate often with stronger transverse veins, not exfoliating. Mesocarp absent. Endocarp dull, brown, septate (segmented fruits) to nonseptate. Seeds 1-20, oblique to transverse, not overlapping, in 1 series. Funiculus 1.5-5 mm long, filiform, curved.

Seed 2.3-9 × 1.5-8 × 2-3 mm, ovate to circular or elliptic to irregular, flattened to compressed or rarely terete. Testa glossy to dull, either monochrome brown (or shades of brown or in combinations with other colors to areola lighter colored) or rarely mottled with various shades of brown to occasionally black, smooth to faintly striate, osseous, with 50 percent to nearly apically connected pleurograms (arms not always of equal length and areola width variable), with or without fracture lines, without wing and aril. Hilum punctiform, exposed or concealed by funicular remnant, flush, subapical. Lens 0.3-0.5 mm long, elliptic to ovate, mound to flush or pit, occasionally surrounded by dark halo, lighter to darker than testa. Endosperm thick to thin, adnate to testa. Cotyledons with simple or basally groined split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule well to moderately developed.

Distribution: New World, Africa, Asia.

Notes: Whereas fruit dehiscence and armature are divisive characters, seed characters are unifying. This genus and its species need revision.

Mimosa seeds: *M. acanthocarpa* Poiret (*D*), *M. andina* Bentham (*B, L*), *M. bracaatinga* Hoehne (*A, Q, T*), *M. camporum* Bentham (*F, M*), *M. galeottii* Bentham (*G, R*), *M. invisa* Martius ex Colla (*E, J*), *M. pigra* Linnaeus (*H, N*), *M. rubicaulis* Lamarck (*C, K*), *M. scabrella* Bentham (*I, P, S*), *M.* spp. (*O*). *A-I*, Seed topography (× 4); *J-N*, cotyledons concealing all but radicle tip (left) and embryonic axes (right) (× 4); *O-T*, testa (× 2, × 50, × 50, × 1,000, × 1,000, × 1,000).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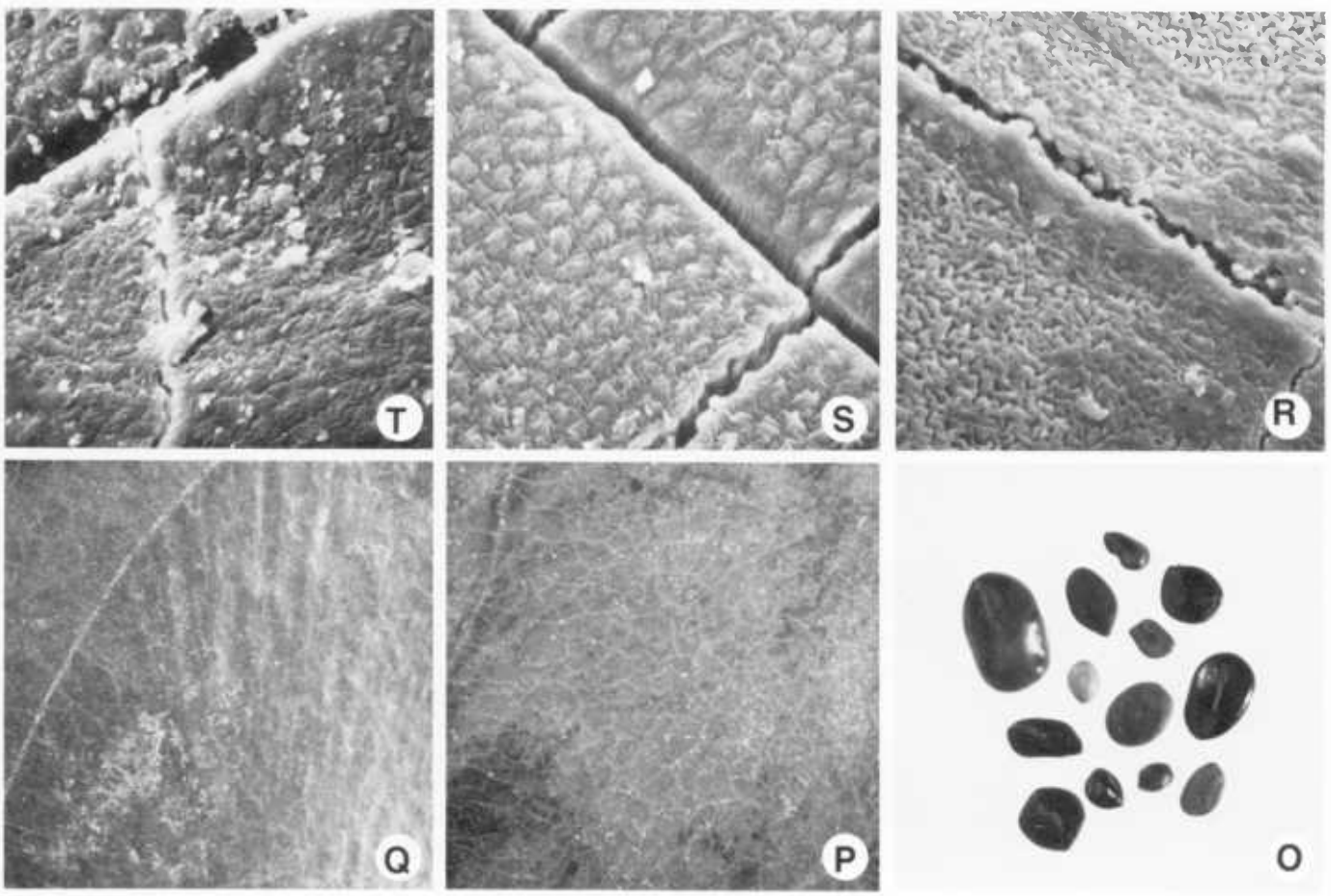
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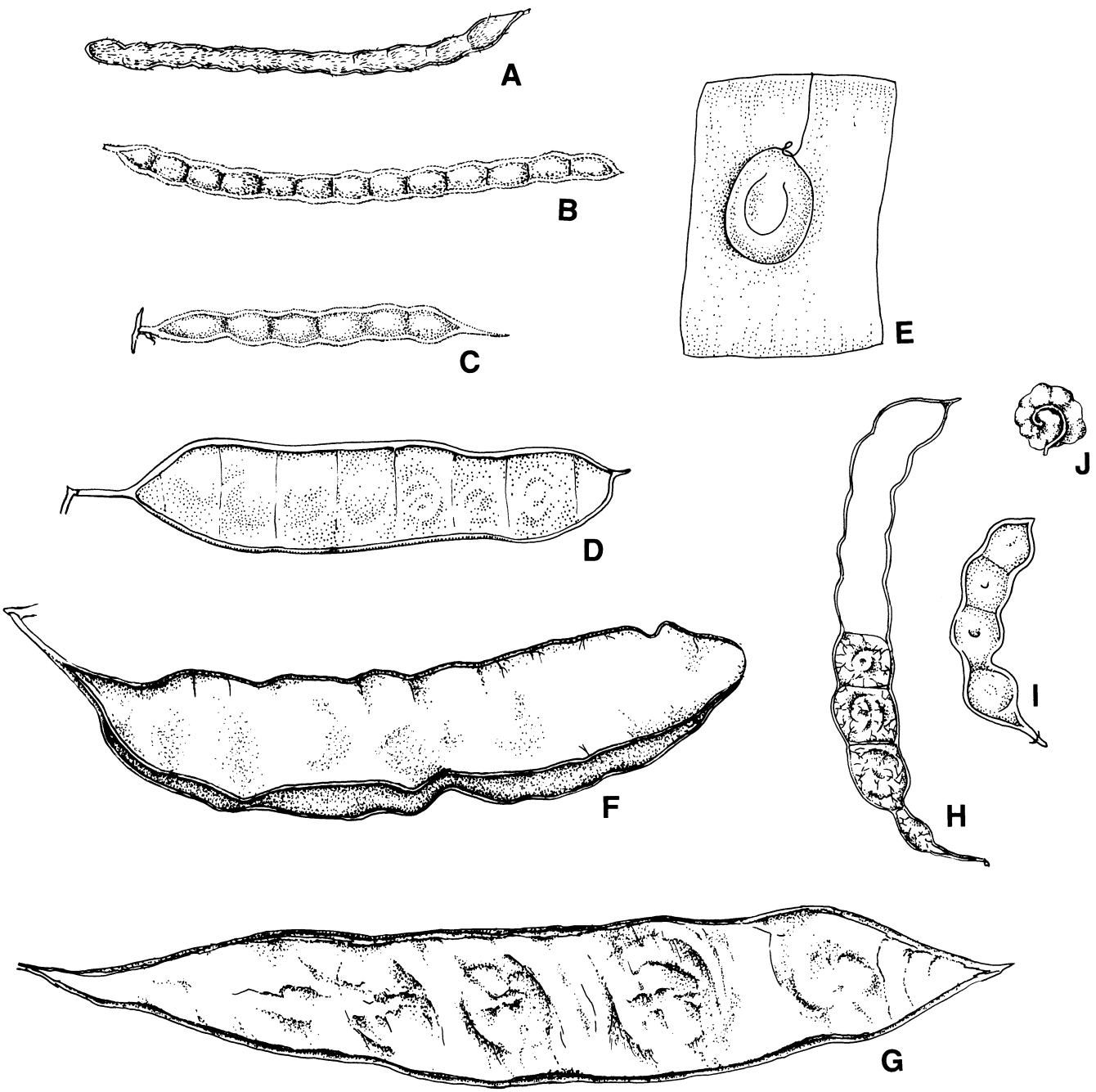
Mimosa fruits without bristles, prickles, or incised fringe: *M. borealis* A. Gray (*I*), *M. dysocarpa* Bentham (*C*), *M. malacophylla* A. Gray (*H*), *M. micrantha* Bentham (*G*), *M. microcephala* Kunth ex Willdenow (*A*), *M. microphylla* Sessé & Mociño (*B*), *M. obovata* Bentham (*D-E*), *M. paniculata* Willdenow (*F*), *M. spirocarpa* N. E. Ross (*J*). *A-D, G, I-J*, Fruits (× 1); *E*, seed in situ (× 3); *F*, dehiscent fruit (× 1); *H*, replum with several valve segments missing (× 1).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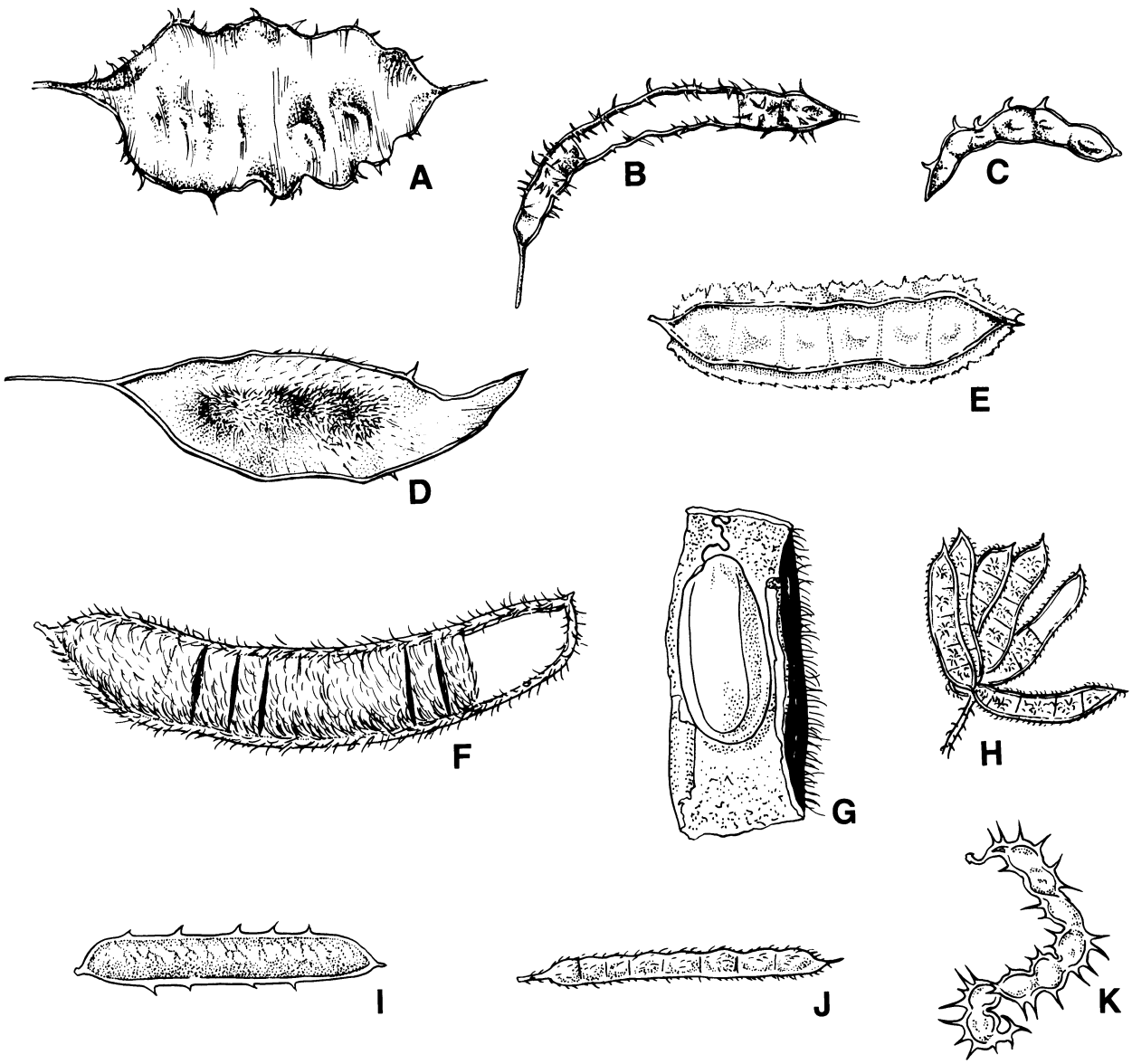
Mimosa fruits with bristles, spines, or incised fringe: *M. acanthocarpa* Poiret (*I*), *M. aspera* M. E. Jones (*F-G*), *M. bahamensis* Bentham (*E*), *M. benthamii* Macbride (*B*), *M. biuncifera* Bentham (*C*), *M. depauperata* Bentham (*K*), *M. eurycarpa* Herzog (*D*), *M. invisa* Martius ex Colla (*H*), *M. platycarpa* Bentham (*A*), *M. somnians* Humboldt & Bonpland ex Willdenow (*J*). *A, C-E, I-K,* Fruits (× 1); *B, F,* replum with several valve segments missing (× 1); *G*, seed in situ (× 3); *H*, fruit cluster (× 1).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Genus: *Schrankia* Willdenow.

Phylogenetic Number: 3.28.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 13 spp. - ca. 19 spp.

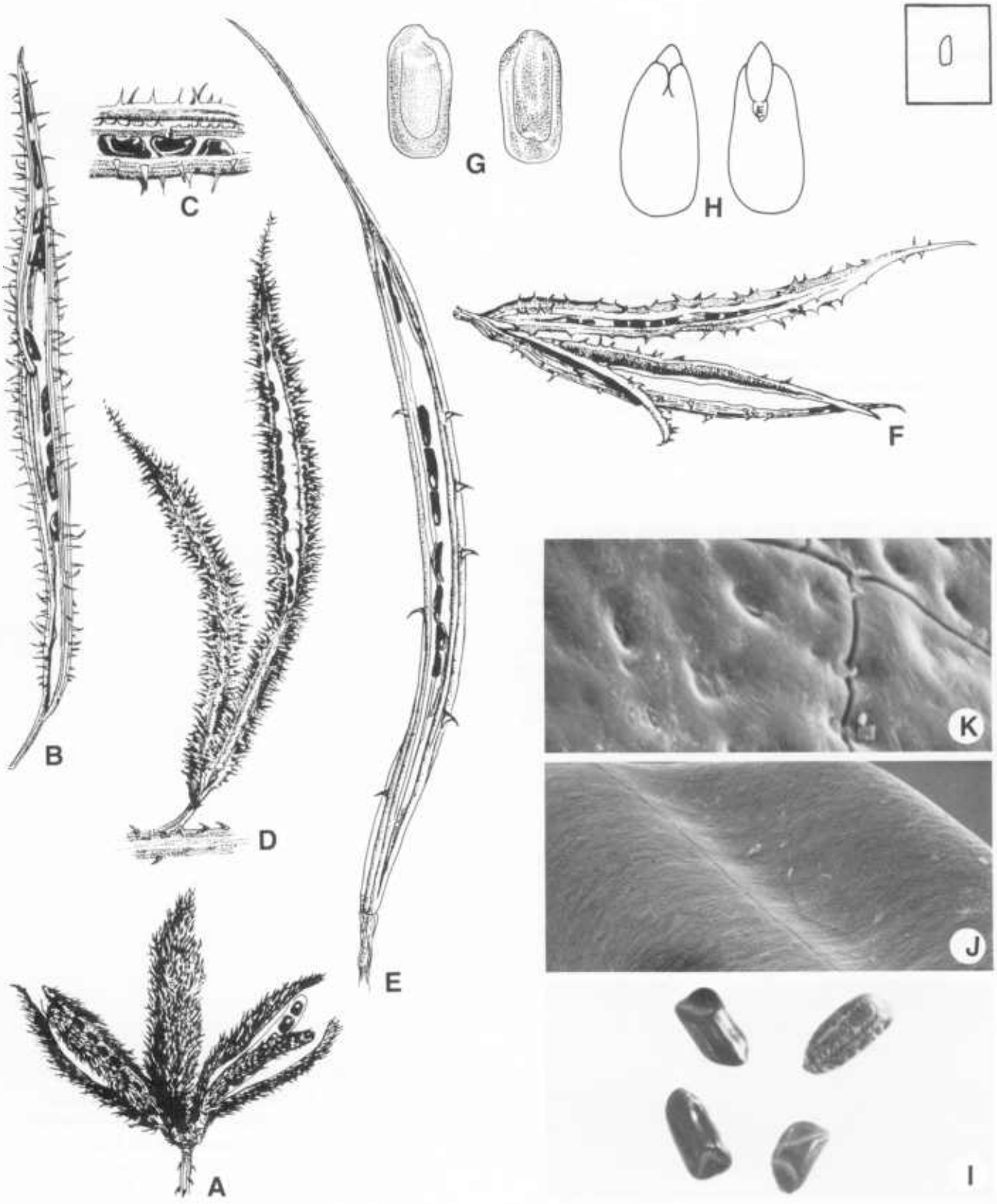
Fruit 2-15 × 0.15-0.6 × 0.2-0.6 cm (excluding prickles up to 3 mm long), straight to curved, without twists, linear to oblong, margins slightly constricted, tapered to apex (usually with beak up to 15 mm long), tapered to base, substipitate, terete to quadrangular or compressed, coriaceous. Valves dehiscing basally to medially and elastically along both sutures and often irregularly fracturing, separating from usually dilated replum bearing numerous to scattered prickles or rarely unarmed, without visible seed chambers. Epicarp dull, ocher to brown, glabrous to pubescent, without prickles or with few distant prickles, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, ocher to brown, subseptate (composed of fiber). Seeds 8-20, parallel, overlapping, in 1 series and remaining in replum after valves fall. Funiculus at least 2 mm long, filiform, curved to contorted.

Seed 3-5.4 × 2.3-2.7 × 1-2 mm, ovate to oblong or rhombic and with or without 1 face of apex and base concaved (caused by overlapping seeds), compressed to subterete. Testa glossy to dull, blackish brown to brown, either smooth or with blistered cuticle and with 2 (rarely 1) longitudinal grooves on each face and usually 1 face of apex and base concaved, osseous, with 75 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, exposed, flush, subapical. Lens 0.2-0.5 mm long, elliptic, slight mound, color of testa or nearly so but with different texture. Endosperm thin, adnate to testa. Cotyledons auriculate over radicle, concealing all but radicle tip, bent reflecting seed shape. Embryonic axis straight. Plumule well developed.

Distribution: Southern United States to Argentina.

Notes: Lewis and Elias (*1981*) mistakenly spelled the genus name, *Schranckia*. This spelling was rejected when *Schrankia* was made a conserved genus name. Isely (*1971a*) and Elias (*1974*) described fruits of U.S. species as rarely smooth and prickles sometimes lacking. Fruit and seed characters do not support the conclusion of Beard (*1963*), who placed all *Schrankia* spp. into the genus *Mimosa* under one species, *M. quadrivalvis* Linneaus. Sutures are usually valvelike and remain with seeds after valves have fallen. Prior to this loss, fruits appear to be four-valved, and after loss of the valves, sutures mistakenly may be thought to be valves.

Schrankia: S. hamata (Kunth) Willdenow (*D*), *S. latidens* (Small) K. Schumann (*F*), *S. leptocarpa* de Candolle (*B-C, G-H, J-K*), *S. microphylla* (Dryander) Macbride (*A*), *S. portoricensis* Urban (*E*), *S.* spp. (*I*). *A*, Fruit cluster (× 1); *B, E,* fruits without valves (× 1); *C,* seeds in situ (× 2); *D*, fruit cluster with entire fruit and fruit without valves (× 1); *F*, fruit cluster without valves (× 1); *G*, seed topography (× 4); *H*, cotyledon concealing about 2/3 of radicle (left) and embryonic axis (right) (× 6); *I-K*, testa (× 4, ×50, × 1,000).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Genus: *Schranckiastrum* Hassler.

Phylogenetic Number: 3.29.

Tribe: Mimoseae.

Group: Piptadenia.

Species Studied - Species in Genus: 1 sp. - 1 sp.

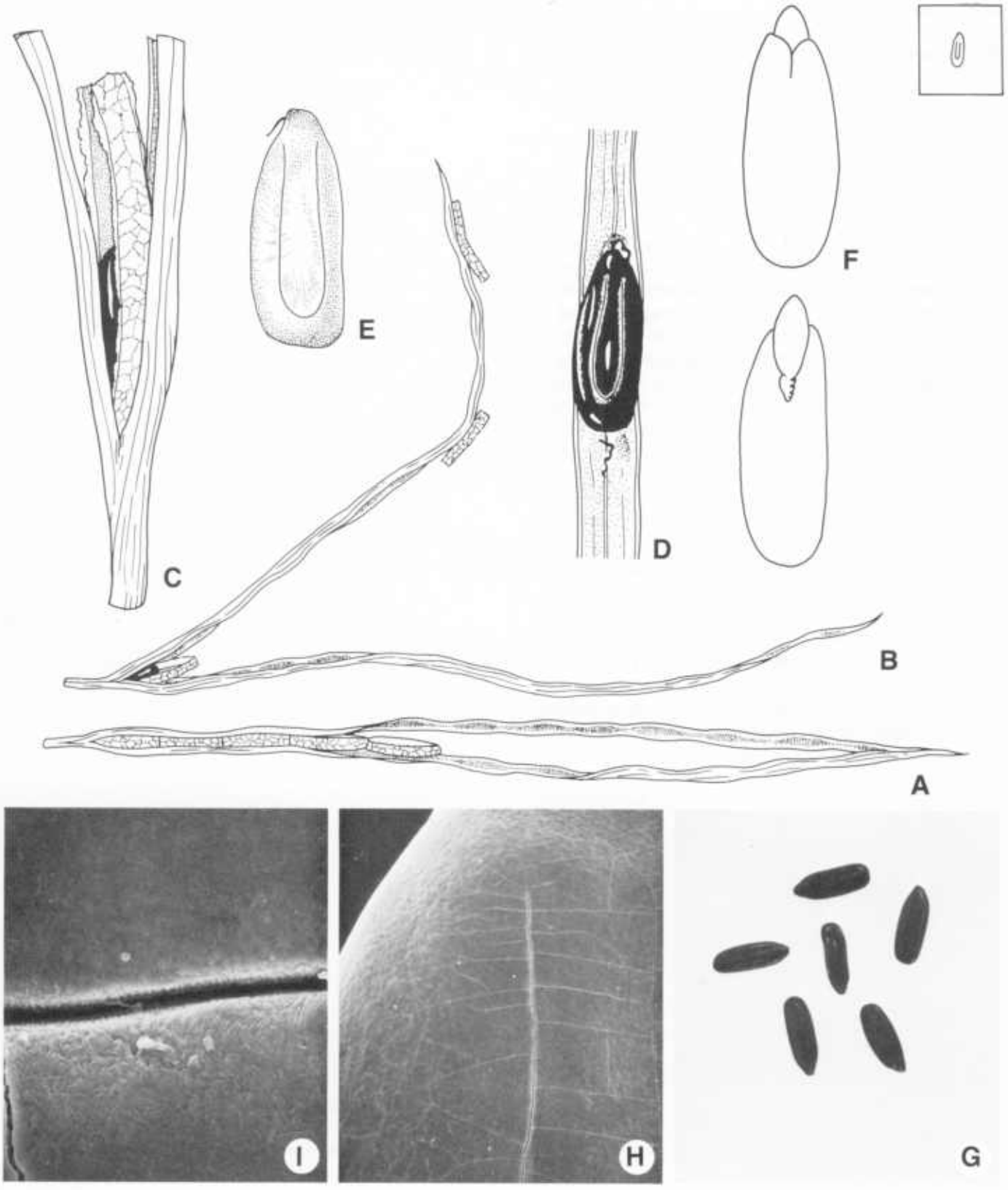
Fruit 8-16 × 0.3-0.4 × 0.3-0.4 cm, straight to curved, without twists, linear, margins constricted, tapered to apex, tapered to stipe 5-6 mm long, terete, coriaceous. Valves dehiscing apically and elastically along both margins and regularly breaking into segments and separating from dilated replum, with visible seed chambers. Epicarp dull, reddish brown, glabrous, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, tan, apparently septate. Seeds 8-12, parallel, not overlapping, in 1 series. Funiculus to 5 mm long, filiform, curved and contorted.

Seed 6.5-7 × 2-2.7 × 1.2-2 mm, oblong, subterete. Testa glossy, dark brown, smooth with 2 (rarely 1) longitudinal grooves on each face, osseous, with 75 percent pleurogram and fracture lines, without wings or aril. Hilum punctiform, exposed, flush, subapical. Lens 0.4 mm long, elliptic, mound, tan. Endosperm thick, adnate to testa. Cotyledons with simple split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule developed.

Distribution: Paraguay.

Notes: Known only from the type. A special effort should be made to collect additional herbarium specimens in flower and fruit.

Schranckiastrum: S. insigne Hassler (*A-I*). *A-B*, Dehiscent fruits (× 1); *C*, valve segment within replum (× 5); *D*, seed in situ (× 5); *E*, seed topography (× 6); *F*, cotyledons concealing all but tip of radicle (upper) and embryonic axis (lower) (× 6); *G-I*, testa (× 3, × 50, × 1,000).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Genus: *Calpocalyx* Harms.

Phylogenetic Number: 3.30.

Tribe: Mimoseae.

Group: Xylia.

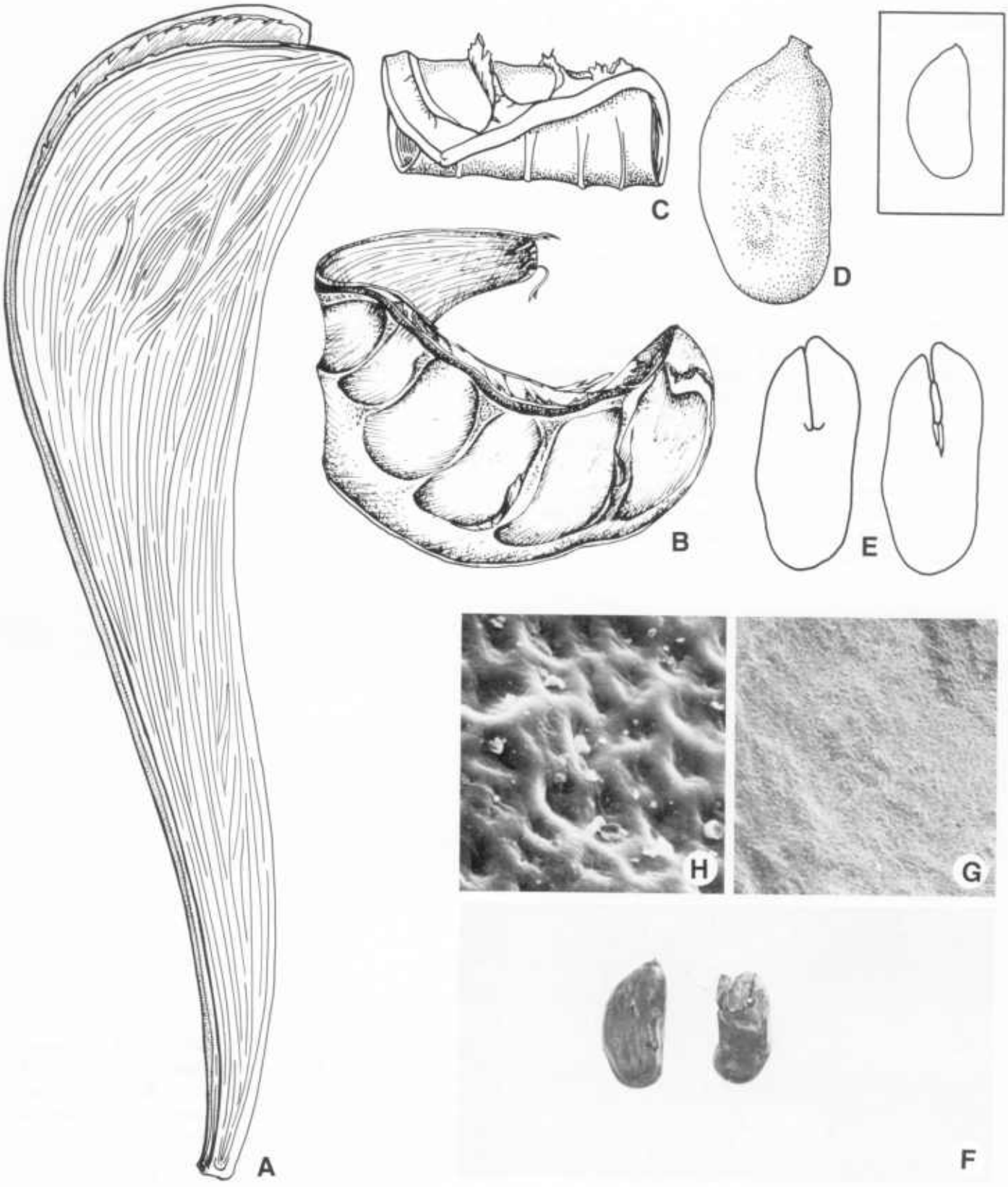
Species Studied - Species in Genus: 5 spp. - 7 spp.

Fruit 10-29 × 2-9 × 0.3-1.5 cm, curved, without twists, dolabriform, margins not constricted, short tapered to apex, long tapered to base, substipitate, compressed, ligneous. Valves dehiscing apically and elastically along both margins and recurving forming loose to tight coil, remaining attached to sutures, without visible seed chambers. Epicarp dull, brown to blackish brown, glabrous, with longitudinal veins, exfoliating or not. Mesocarp fibrous, ligneous. Endocarp dull, reddish brown, subseptate. Seeds 3-10, oblique, not overlapping, in 1 series. Funiculus 2 mm long, thick, triangular (base up to 5 mm wide).

Seed 20-45 × 10-25 × 0.7-0.8 mm, elliptic with 1 straight side, compressed. Testa glossy, brown, faintly reticulate, coriaceous, without pleurogram or fracture lines or wing or aril. Hilum oblong, 0.3 mm long, concealed by funicular remnant, flush, almost apical. Lens not discernible. Endosperm absent. Cotyledons with basally groined split over radicle, concealing radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: West Africa.

Calpocalyx: C. aubrevillei Pellegrin (*A*), *C. brevibracteatus* Harms (*B*), *C. dinklagei* Harms (*C-H*). *A*, Dehiscent fruit (× 1); *B*, valve (× 1); *C*, coiled valve (× 1); *D*, seed topography (× 2); *E*, cotyledon concealing radicle (left) and embryonic axis (right) (× 2); *F-H*, testa (× 1, × 50, × 1,000).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Genus: *Xylia* Bentham.

Phylogenetic Number: 3.31.

Tribe: Mimoseae.

Group: Xylia.

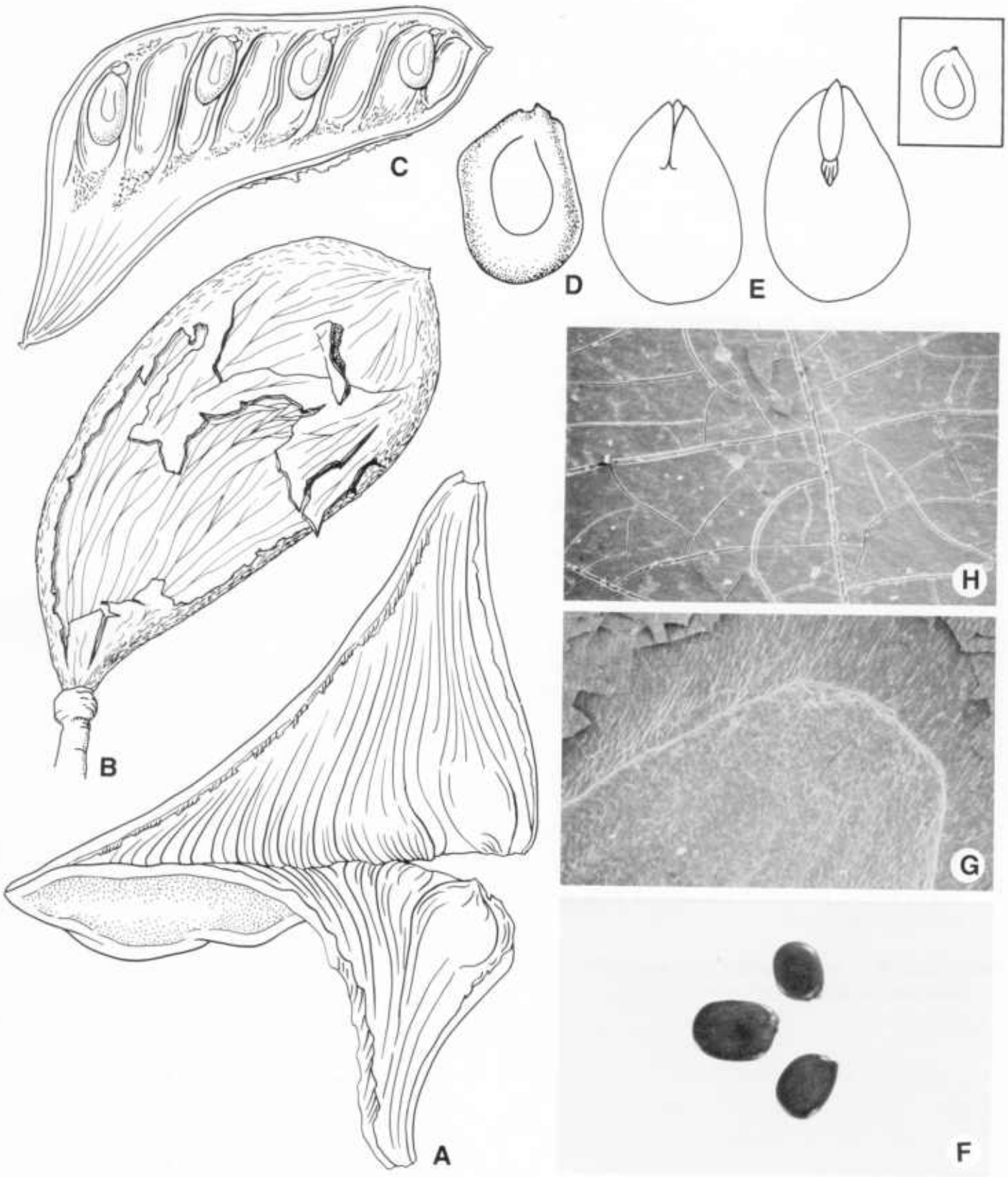
Species Studied - Species in Genus: 5 spp. - ca. 13 spp.

Fruit 9-25 × 3-7 × 1-2 cm, curved, without twists, obliquely obovate to oblanceolate or dolabriform, margins not constricted, short tapered to apex, long tapered to base, nonstipitate, compressed, ligneous. Valves dehiscing apically and elastically along both margins and recurving eventually falling apart, remaining attached to sutures, without visible seed chambers. Epicarp dull, brown, glabrous to partially pubescent, longitudinally venose and shagreen, checking and exfoliating. Mesocarp fibrous, ligneous. Endocarp dull, reddish brown, subseptate. Seeds 4-10, oblique to transverse, not overlapping, in 1 series. Funiculus 2.5-3 mm long, thick, straight.

Seed 12-20 × 6-10 × 3-5 mm, ovate to oblong, compressed. Testa glossy, brown, monochrome or mottled, smooth, osseous, with 75-100 percent pleurogram and fracture lines, without wing or aril. Hilum punctiform to somewhat oblong, concealed by funicular remnant, raised, apical to subapical. Lens 0.5 mm long, elliptic, mound, brown. Endosperm absent. Cotyledons with basally groined split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: Africa, Madagascar, India to Indochina.

Xylia: X. hoffmannii (Vatke) Drake (*C*), *X. torreana* Brenan (*B*), *X. xylocarpa* (Roxburgh) Taubert (*A, D-H*). *A*, Dehiscent fruit (× 1); *B*, fruit with epicarp exfoliating from mesocarp (× 1); *C*, seeds in situ (× 1); *D*, seed topography (× 2); *E*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 2); *F-H*, testa (× 1, × 50, × 1,000).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Genus: *Leucaena* Bentham.

Phylogenetic Number: 3.32.

Tribe: Mimoseae.

Group: Leucaena.

Species Studied - Species in Genus: 19 spp. - ca. 40 spp.

Fruit 8-20 × 1-1.5 × 0.2-0.3 cm, straight to slightly curved, without twists, broadly linear to linear or oblong, margins not constricted to irregularly slightly constricted, short tapered to tapered or rounded, short tapered to tapered to stipe up to 30 mm long or substipitate, compressed, coriaceous. Valves dehiscing apically along both sutures, remaining attached to sutures with or without visible seed chambers. Epicarp glossy, brown to blackish brown or reddish, glabrous to densely covered with reddish scales or white hairs, reticulate, exfoliating. Mesocarp absent. Endocarp dull, ocher with brown seed chambers, subseptate to nonseptate. Seeds 6-26, transverse to oblique, not overlapping, in 1 series. Funiculus 4.5 mm long, thick, S-curved.

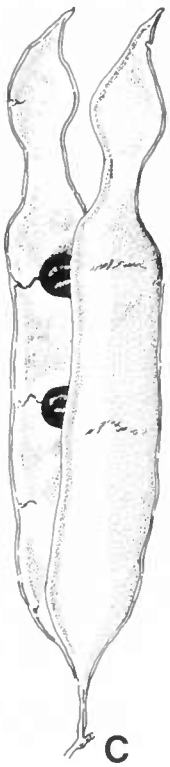
Seed 5-10 × 3.5-7 × 1-2 mm, ovate to circular or oblong, compressed. Testa glossy, brown, smooth to shallowly pitted especially outside of areola and bearing line (more like a ridge) from apex to middle of areola, osseous, with 75-90 percent pleurogram and fracture lines, without wing or aril. Hilum punctiform, exposed, flush, subapical. Lens 0.3-0.4 mm long, either linear and inconspicuous or elliptic and conspicuous, mound, tan to whitish. Endosperm thin to thick, adnate to testa. Cotyledons auriculate over radicle, concealing only margins of radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: West Indies, Central America, South America, introduced elsewhere.

Leucaena: L. esculenta (Mociño & Sessé) Bentham (*B*), *L. leucocephala* (Lamarck) de Wit (*D, F, H-I*), *L. retusa* Bentham (*A*), *L. stenocarpa* Urban (*C*), *L. tricodes* (Jacquin) Bentham (*E*), *L.* spp. (*G*). *A-B*, Fruits (× 1); *C*, dehiscent fruit (× 1); *D-E*, seed topography (× 5); *F*, cotyledon concealing about 1/3 of radicle (left) and embryonic axis (right) (× 5); *G-I*, testa (× 2, × 50, × 1,000).


A


B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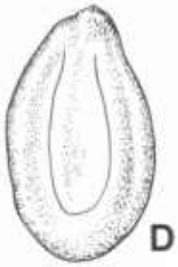
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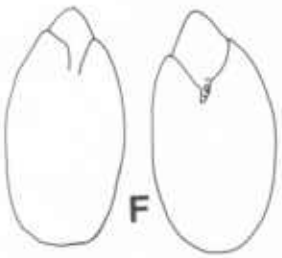
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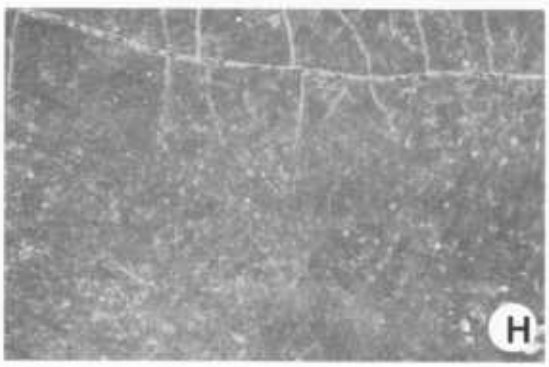

H


G

Genus: *Schleinitzia* Warburg ex Guinet.

Phylogenetic Number: 3.33.

Tribe: Mimoseae.

Group: Leucaena.

Species Studied - Species in Genus: 3 spp. - 4 spp.

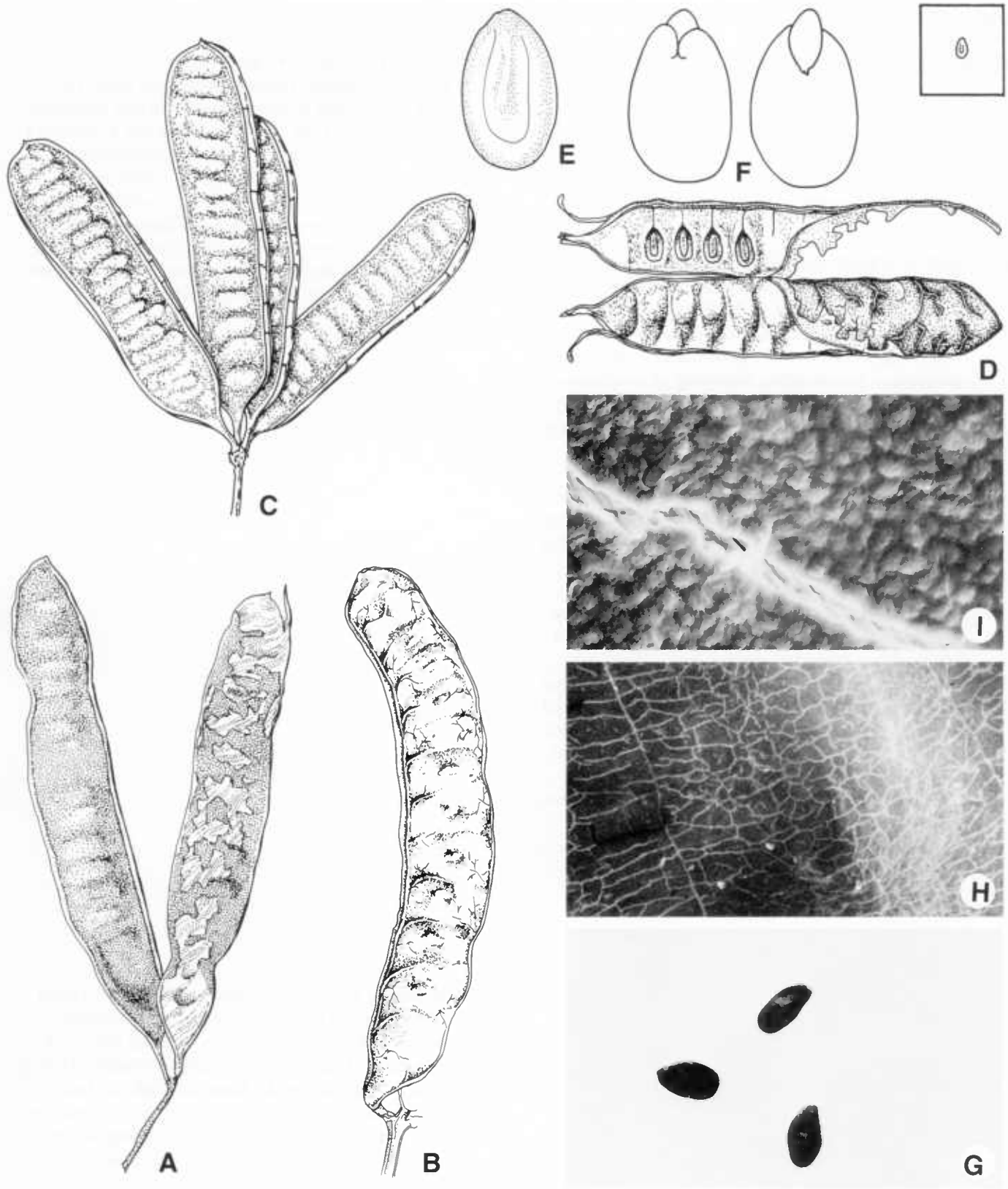
Fruit 3.5-11.8 × 1.2-2.5 × 0.3-0.4 cm, straight to curved, without twists, oblong to broadly linear, margins not constricted to slightly constricted, short tapered to rounded to apex, short tapered to stipe up to 5 mm long or substipitate, flattened, coriaceous. Valves tardily dehiscent (gaping along ventral margin, eventually gaping along dorsal suture and finally dehiscing but not separating like valves in fruits from other mimosoid genera), remaining attached to sutures, with visible seed chambers. Epicarp glossy, blackish to reddish brown, glabrous, reticulate or not, remaining intact to cracking and exfoliating. Mesocarp absent. Endocarp dull, tan, subseptate. Seeds 8-20, transverse, not overlapping, in 1 series. Funiculus 3-5 mm long, filiform, coiled.

Seed 4-6 × 2-4 × 1-2 mm, oblong, compressed. Testa glossy, brown to blackish brown, smooth, osseous, with 75 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, exposed, recessed, subapical. Lens 0.3 mm, circular to elliptic, mound, tan. Endosperm thick, adnate to testa. Cotyledons auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule rudimentary.

Distribution: Pacific.

Notes: Nevling and Niezgoda (*1978*) monographed this genus, recognizing three species. Verdcourt (*1979*) described the fruits as septate. The author of the genus is based on the reference by Nevling and Niezgoda and not on that by Lewis and Elias (*1981*).

Schleinitzia: S. fosbergii Nevling & Niezgoda (*A*), *S. insularum* (Guillemin) Burkart (*B, D*), *S. novo-guineensis* (Warburg) Verdcourt (*C, E-F, H-I*), *S.* spp. (*G*). *A, C,* Fruit clusters (× 1); *B,* fruit (× 1); *D,* seeds in situ (× 1); *E,* seed topography (× 7); *F,* cotyledons concealing all but radicle tip (left) and embryonic axis (right) (× 7); *G-I,* testa (× 3, × 50, × 1,000).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Genus: *Dichrostachys* (de Candolle) Wight & Arnott.

Phylogenetic Number: 3.34.

Tribe: Mimoseae.

Group: Dichrostachys.

Species Studied - Species in Genus: 3 spp. - ca. 12 spp.

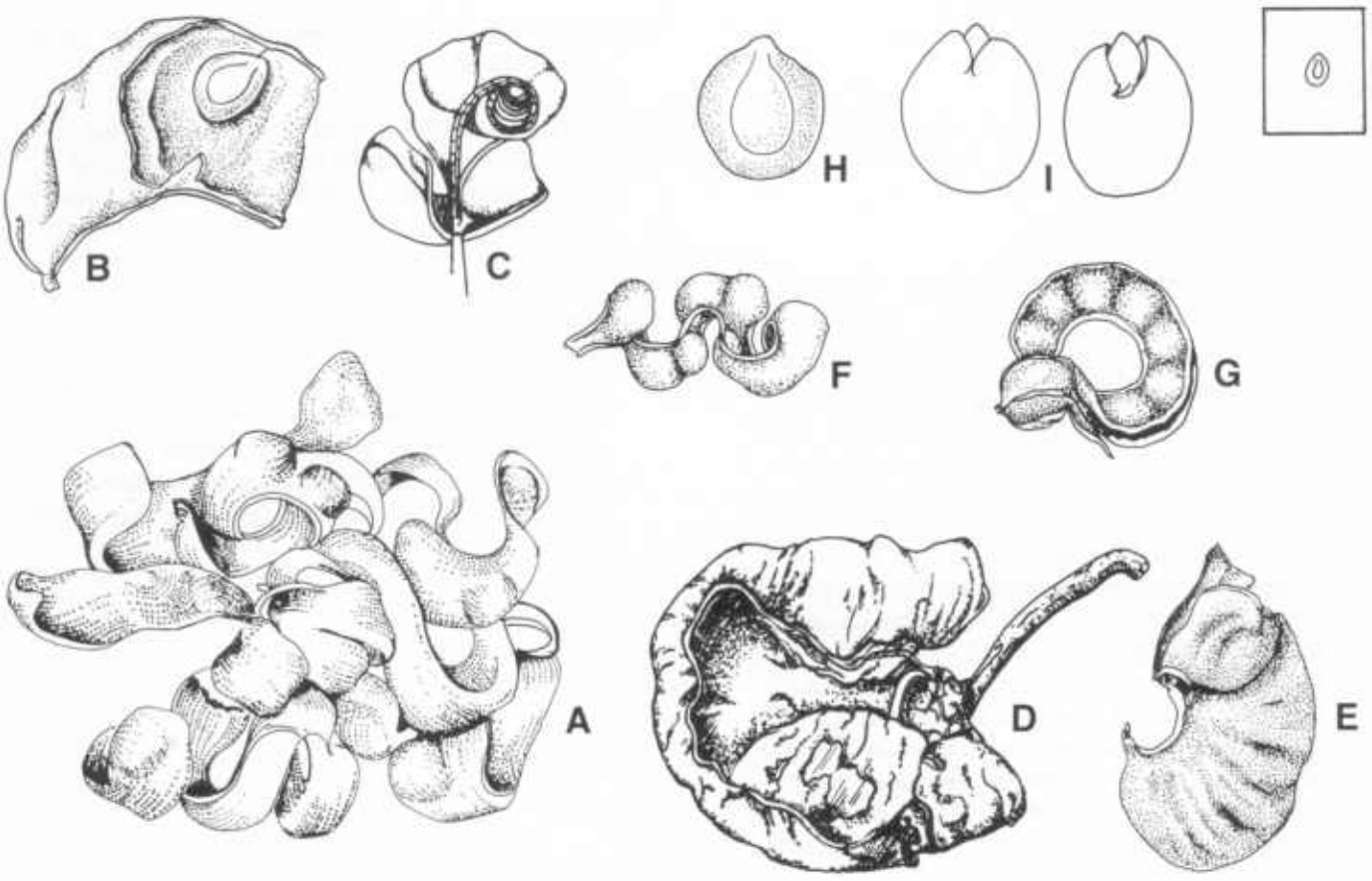
Fruit 2-10 × 0.4-3.5 × 0.2-0.8 cm, curved to 1-coiled, undulate and contorted and with or without twists, broadly linear to linear or reniform, slightly constricted to not constricted, rounded to apex, rounded to short tapered to base, nonstipitate, compressed, coriaceous. Valves either dehiscing or indehiscent, either remaining attached or irregularly breaking from sutures, with visible seed chambers. Epicarp glossy, brown to blackish red, either pubescent when young and becoming glabrate with age or glabrous, reticulate or not, not exfoliating. Mesocarp absent. Endocarp dull, tan, nonseptate. Seeds 4-8, oblique, not overlapping, in 1 series. Funiculus 2.5-2.7 mm long, filiform, coiled.

Seed 4-6 × 3-4.5 × 1-2.3 mm, elliptic to ovate or oblong, compressed. Testa glossy to dull, brown, smooth to minutely pitted, coriaceous, with 75 percent pleurogram, with or without fracture lines, without wing or aril. Hilum punctiform, exposed, recessed, subapical. Lens either not discernible or discernible and 0.2-0.3 mm long, triangular to elliptic or circular, flush to mound or pit and surrounded by ocher and/or darker brown patch or patch absent, ocher to dark brown. Endosperm thin to thick, adnate to testa. Cotyledons auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: Africa to Australia.

Notes: Also see notes for *Gagnebina*, 3.35. Fruits of *D. cinerea* subsp. *platycarpa* may be dimorphic. One type shown in *D* was found on two specimens, and the other type shown in (*E*) is not a complete fruit and resembles the other *Dichrostachys* fruits. Brenan in Brenan and Brummitt (*1965*) and in personal communication, 1982, considered *D. cinerea, D. glomerata* (Forsskal) Chiovenda, and *D. platycarpa* to be 1 species with 10 subspecies and *D. cinerea* to be the correct name for this complex. Fruits of the African taxa are indehiscent.

Dichrostachys: D. cinerea (Linnaeus) Wight & Arnott subsp. *cinerea* (*A-C, F, H-I, K-L*), *D. cinerea* subsp. *platycarpa* (Welwitsch ex Bull) Brenan & Brummitt (*D-E*), *D. spicata* (F. v. Mueller) Domin (*G*), *D.* spp. (*J*). *A, C*, Fruit clusters (× 1); *B*, seed in situ (× 2); *D-G*, fruits (× 1); *H*, seed topography (× 3); *I*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 3); *J-L*, testa (× 2, × 50, × 50).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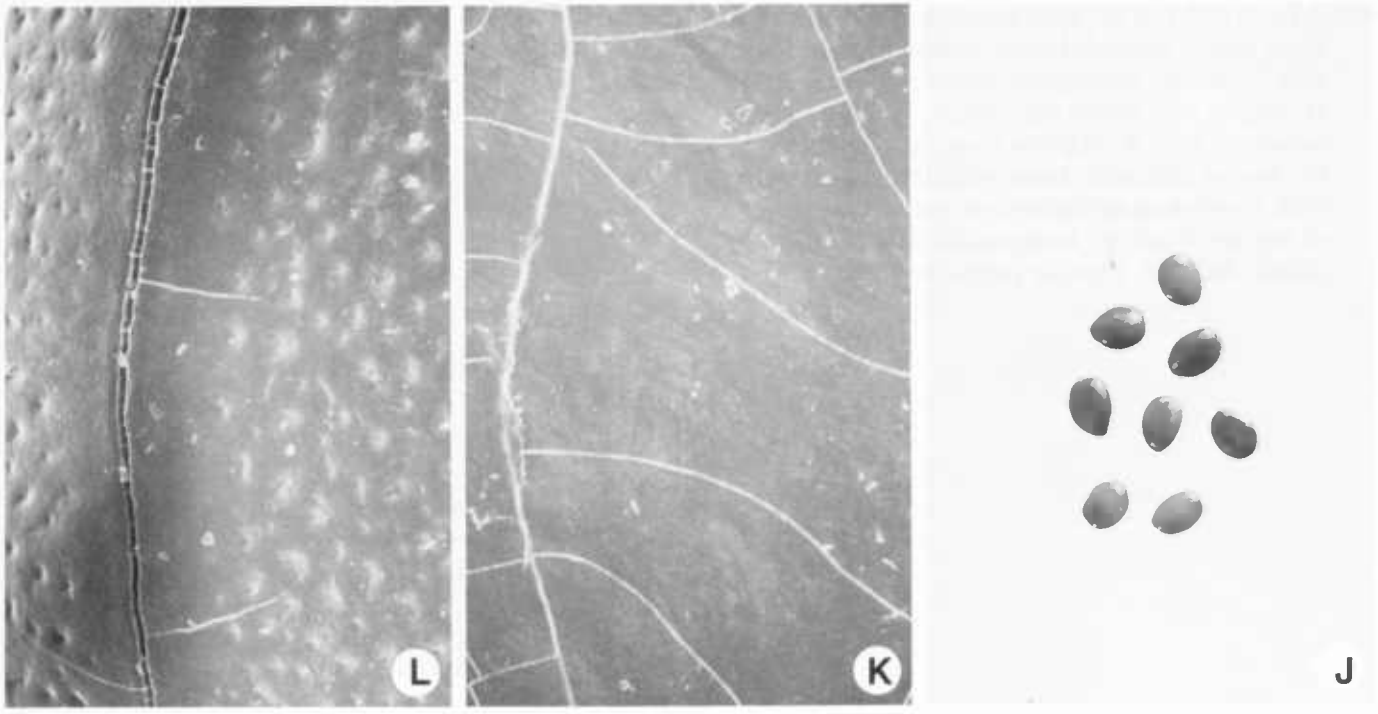
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Genus: *Gagnebina* Necker.

Phylogenetic Number: 3.35.

Tribe: Mimoseae.

Group: Dichrostachys.

Species Studied - Species in Genus: 2 spp. - ca. 4-5 spp.

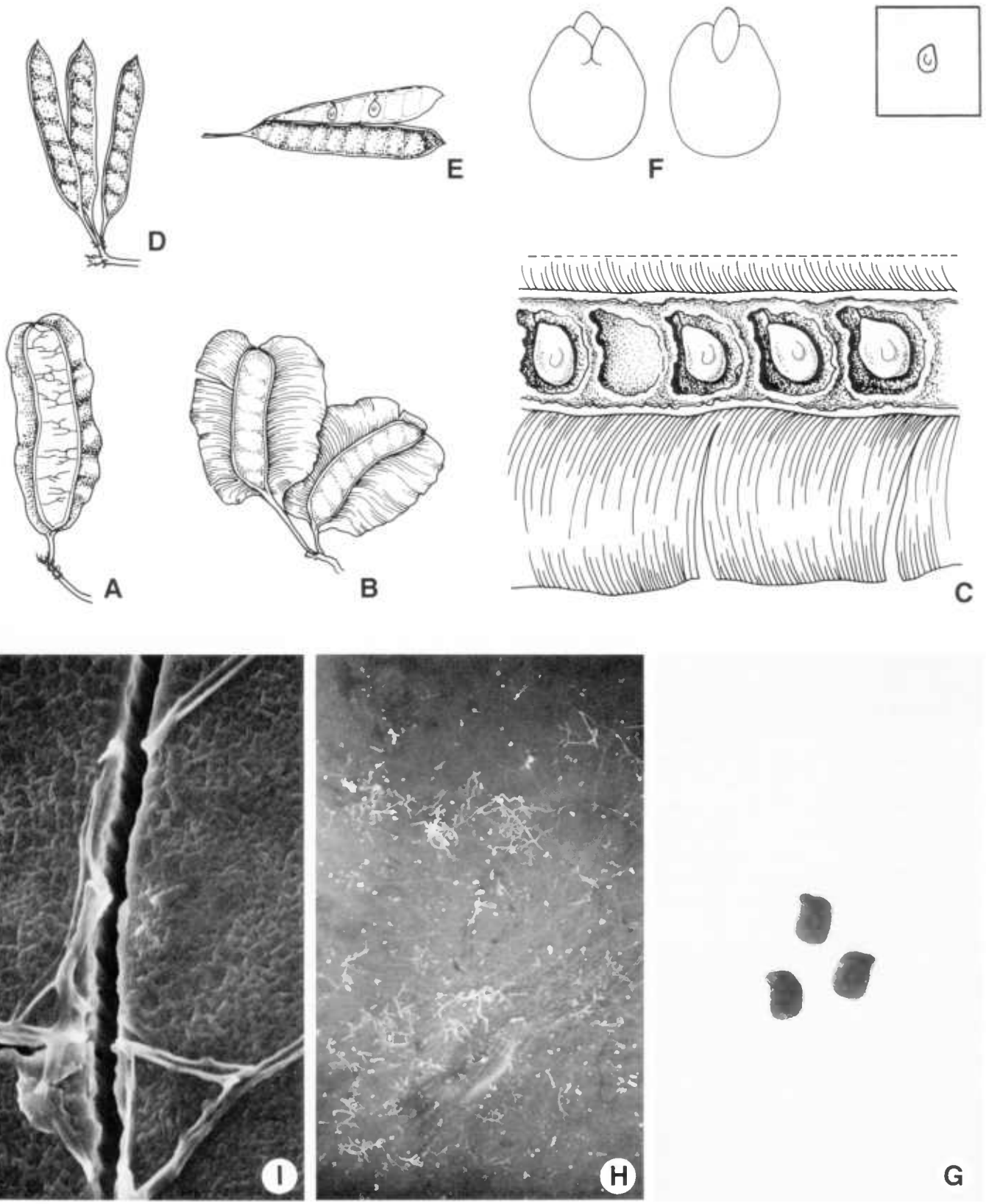
Fruit 4.5-5 × 0.8-2.5 × 0.1 cm, straight to slightly curved, without twists, oblong to linear, margins not constricted and either with transversely striate membranous wing 0.1-10 mm wide or wingless, rounded or if winged emarginate to apex, short tapered to stipe 10 mm long, compressed, coriaceous. Valves either indehiscent or dehiscing apically along both margins, remaining attached to sutures, with or without visible seed chambers. Epicarp glossy, brown, pubescent when young and glabrate at maturity, transverse reticulate and smooth to knobbed over seed chamber, not exfoliating. Mesocarp absent. Endocarp dull, brown within seed chambers and whitish between seeds, septate to subseptate. Seeds 5-7, oblique, not overlapping, in 1 series. Funiculus 1.5 mm long, filiform, sharply curved.

Seed 2.5-3 × 2-2.5 × 0.1 mm, ovate, compressed. Testa glossy, greenish brown, smooth, coriaceous, with 75 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, exposed, flush, subapical. Lens 0.1-0.2 mm long, circular to elliptic, mound yellowish. Endosperm thin, adnate to testa. Cotyledons auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight to slightly deflexed. Plumule rudimentary.

Distribution: Madagascar, Mascarene, and other India Ocean islands.

Notes: Renvoize (*1972*) placed *G. commersoniana* in *Dichrostachys* based on fruit morphology, not flower morphology (flowers are similar to those of *Gagnebina*). By doing this he expected species of *Gagnebina* to have winged fruits and species of *Dichrostachys* to have wingless fruits; whereas *Dichrostachys* species would have wingless fruits, the placement of *G. commersoniana* in *Gagnebina* does not adversely impact on the winged fruits in this genus. The wings on *G. tamariscina* fruits vary from virtually wingless to winged, from 0.1 to 10 mm wide. Lewis and Elias (*1981*) support the placement of *G. commersoniana* in *Gagnebina*.

Gagnebina: G. commersoniana (Baillon) R. Viguier (*D-F*), *G. tamariscina* de Candolle (*A-C, G-I*). *A*, Fruit (× 1); *B, D,* fruit clusters (× 1); *C,* seeds in situ (× 3); *E,* dehiscent fruit (× 1); *F,* cotyledon concealing all but tip of radicle (left) and embryonic axis (right) (× 4); *G-I,* testa (× 1, × 50, × 1,000).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Genus: *Desmanthus* Willdenow.

Phylogenetic Number: 3.36.

Tribe: Mimoseae.

Group: Dichrostachys.

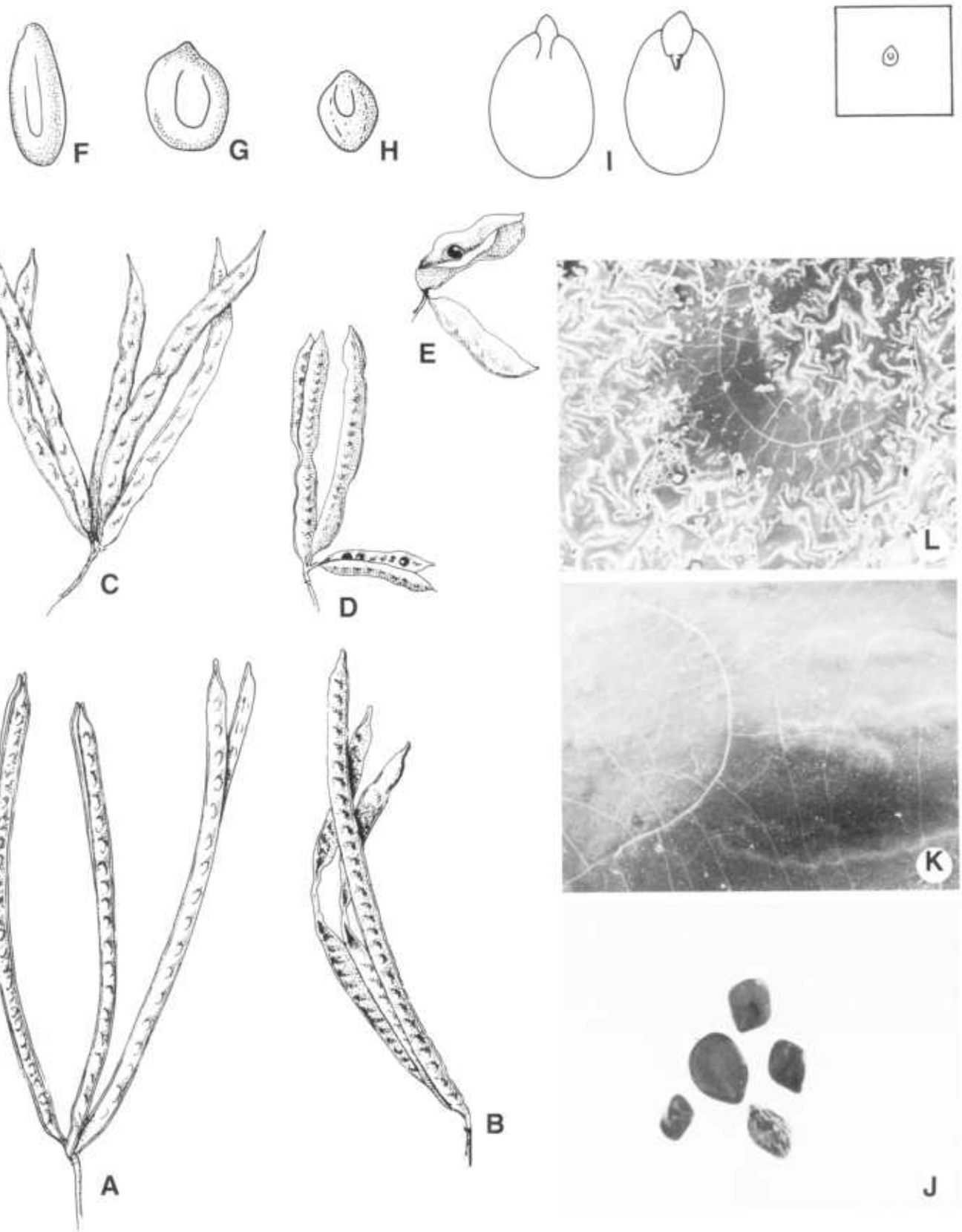
Species Studied - Species in Genus: 7 spp. - 25 spp.

Fruit 1.5-9.5 × 0.2-0.5 × 0.1-0.3 cm, straight to ½-coiled, without twist, linear to broadly linear or oblong, margins not constricted to constricted, short tapered to apex, tapered to base, substipitate, compressed to subterete, coriaceous. Valves dehiscing apically either along both margins and scissoring apart or along dorsal margin, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown to black, glabrous to glabrate, reticulate, cracking but not exfoliating. Mesocarp absent. Endocarp dull, tan, nonseptate but with seed depressions to subseptate. Seeds 4-30, oblique to parallel, not overlapping, in 1 series. Funiculus 0.5-1 mm long, filiform, S-curved.

Seed 2.5-5 × 2-3 × 0.5-1.5 mm, ovate to rhombic or irregular, compressed. Testa glossy, brown, smooth to bearing either irregular lines of pustules or cuticle with buff-colored blisters, osseous, with 50-75 percent pleurogram (with equal or unequal arms) and fracture lines, without wing or aril. Hilum punctiform, concealed by funicular remnant, flush, subapical. Lens 0.2-0.3 mm long, elliptic to linear or poorly defined, flush and with or without black patch between lens and hilum, buff. Endosperm thick, adnate to testa. Cotyledons auriculate over radicle, concealing only margins of radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: Tropical to temperate America, introduced elsewhere.

Desmanthus: D. bicornutus S. Watson (*C*), *D. illinoensis* (Michaux) MacMillan ex Robinson & Fernald (*E, G, I*), *D. interior* (Britton & Rose) Bullock (*K-L*), *D. leptolobus* Torrey & Gray (*F*), *D. virgatus* (Linnaeus) Willdenow var. *depressus* (Humboldt & Bonpland ex Willdenow) B. L. Turner (*D*), *D. virgatus* (Linnaeus) Willdenow var. *virgatus* (*A-B, H*), *D.* spp. (*J*). *A-E*, Fruit clusters with, except *C*, 1 or more dehiscent fruits (× 1); *F-H*, seed topography (× 4); *I*, cotyledon not concealing radicle (left) and embryonic axis (right) (× 4); *J-L*, testa (× 2, × 50, × 50).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Genus: *Neptunia* Loureiro.

Phylogenetic Number: 3.37.

Tribe: Mimoseae.

Group: Dichrostachys.

Species Studied - Species in Genus: 8 spp. - ca. 12 spp.

Fruit 0.7-5.5 × 0.5-1.7 × 0.1-0.2 cm, straight to curved or circular, without twists, oblong to linear or circular, margins not constricted to slightly constricted, rounded to apex, short tapered to rounded to usually deflexed stipe up to 12 mm long or substipitate, compressed to flattened, coriaceous to membranous. Valves dehiscing apically either by dorsal margin or by both margins, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown to reddish brown or black, glabrous to eglandular or glandular pubescent, parallel veined from margins to center, not exfoliating. Mesocarp absent. Endocarp dull, tan, subseptate (composed of hairs). Seeds 1-20, transverse to oblique, not overlapping, in 1 series. Funiculus 1.5 mm long, filiform, curved.

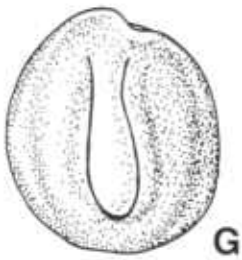
Seed 4-5.5 × 2.1-5 × 0.1-0.3 mm, ovate to oblong or circular, compressed. Testa glossy, brown, pitted (alined or scattered) to smooth and cuticle may be blistered, osseous, with 75 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, exposed, flush or nearly so, subapical to apical. Lens 0.2 mm long, elliptic, mound in depression, blackish. Endosperm thin, adnate to testa. Cotyledons auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule rudimentary.

Distribution: Tropical and subtropical America, Africa, Asia, Australia.

Notes: Windler (*1966, 1974*) monographed the genus.

Neptunia: N. dimorphantha Domin (*F-I, K*), *N. gracilis* Bentham (*A*), *N. lutea* (Leavenworth) Bentham (*C*), *N. oleracea* Loureiro (*E*), *N. plena* (Linnaeus) Bentham (*B*), *N. pubescens* Bentham (*D*), *N.* spp. (*J*). *A-E*, Fruit clusters (× 1); *F*, fruit (× 1); *G*, seed topography (× 6); *H*, seeds in situ (× 2); *I*, cotyledons concealing all but tip of radicle (left) and embryonic axis (right) (× 6); *J-K*, testa (× 3, × 50).


F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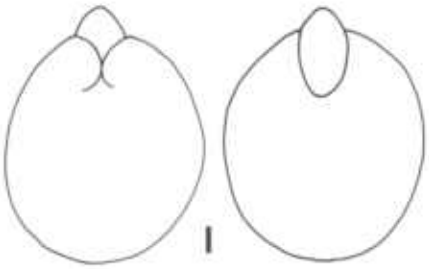
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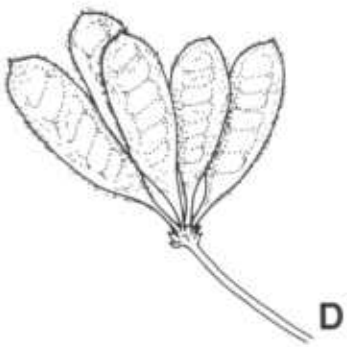
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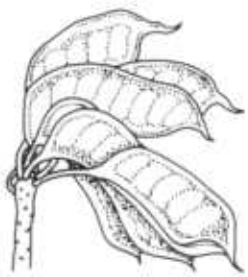
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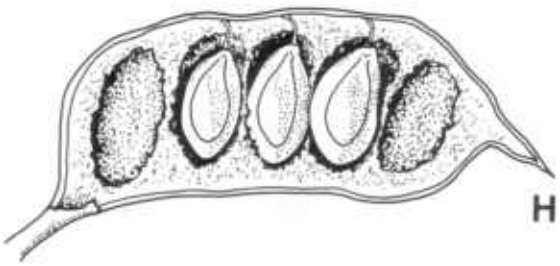
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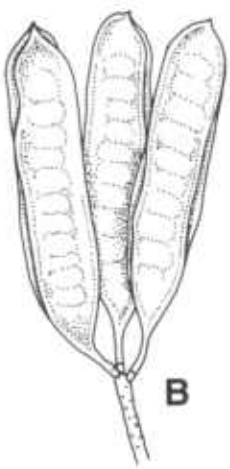
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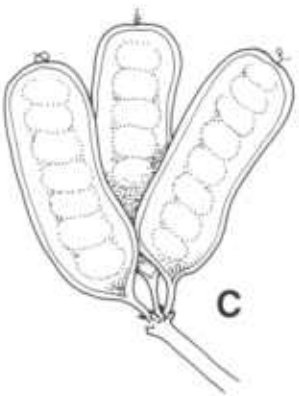
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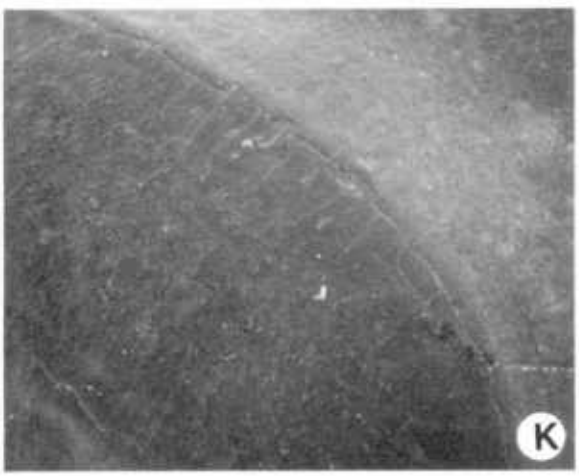
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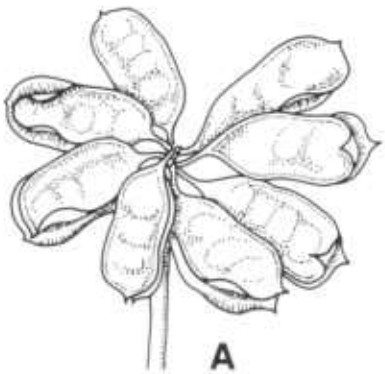

A


J

Acacieae (4.01-4.02)

Genus: *Faidherbia* A. Chevalier.

Phylogenetic Number: 4.01.

Tribe: Acacieae.

Species Studied - Species in Genus: 1 sp. - 1 sp.

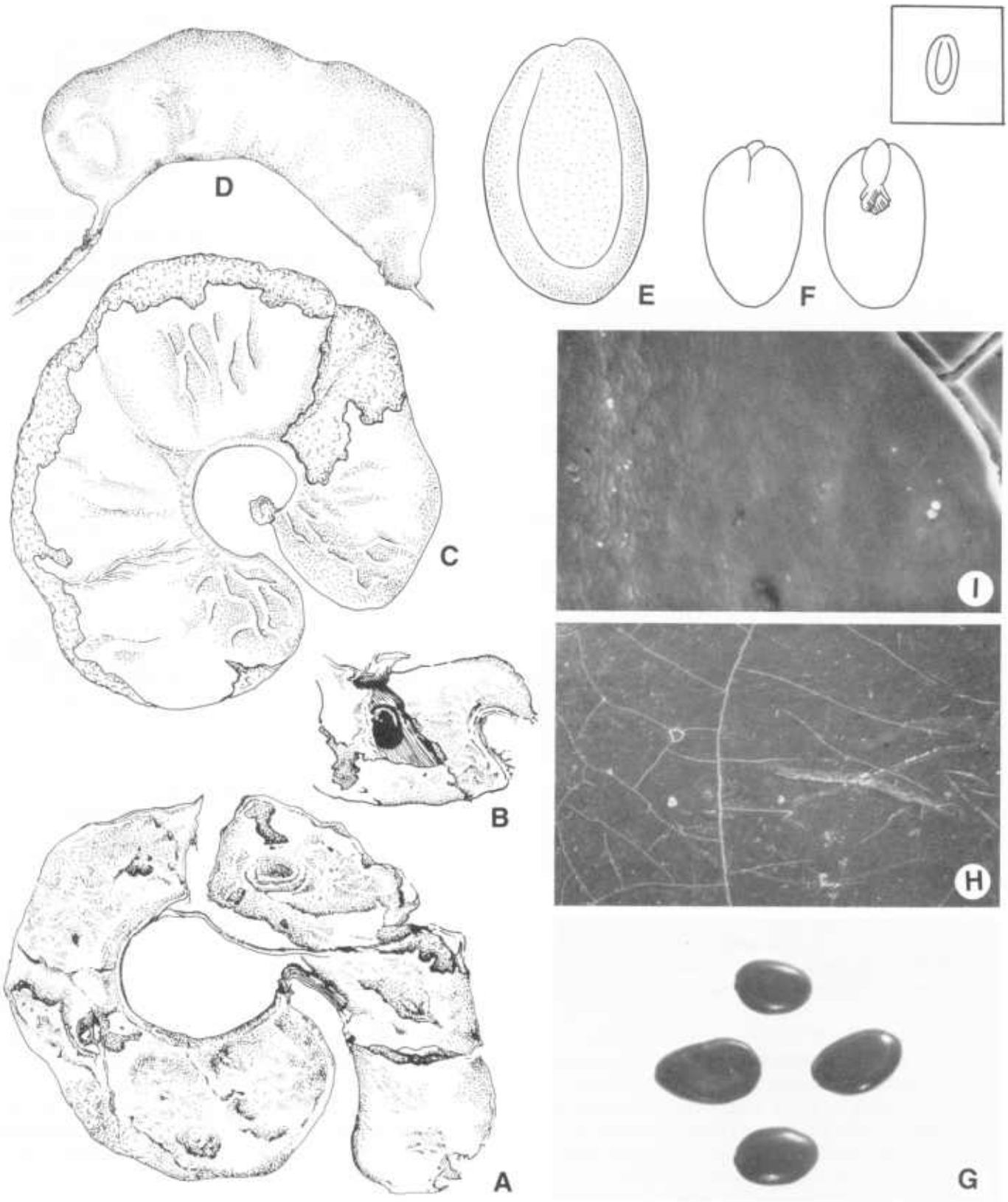
Fruit 5.8-35 × 1.4-5 × 0.6-1.3 cm, curved to 1-coiled or contorted, with or without twists, oblong, margins not constricted, rounded to tapered to apex, rounded to tapered to stipe up to 5 mm long or substipitate, compressed, ligneous. Valves indehiscent, remaining attached to sutures, with or without faintly visible seed chambers. Epicarp dull, orange (when fresh) and reddish brown (when dry), glabrous to puberulent, when young fleshy and paralled veined from ventral margin but anastomosing before reaching dorsal margin and when mature leathery and with or without visible veins, not exfoliating. Mesocarp fibrous, ligneous. Endocarp dull, tan, nonseptate. Seeds 10-22, transverse, not overlapping, in 1 series. Funiculus to 3 mm long, thick, straight.

Seed 6-12 × 3.8-8 × 2.2-3.4 mm, oblong to subcircular, compressed. Testa glossy, brown, smooth, osseous, with 75-100 percent pleurogram and fracture lines, without wing or aril. Hilum punctiform, exposed, recessed, subapical. Lens 0.4-0.5 mm long, linear, groove, dark. Endosperm thin, adnate to testa. Cotyledons with simple split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule well developed.

Distribution: Tropical and subtropical Africa.

Notes: *Faidherbia* fruits and seeds were thoroughly studied and illustrated by Nongonierma (*1978, 1979*) as *Acacia albida* Delile. Neither fruit nor seed characters support this segregate monotypic genus.

Faidherbia: F. albida (Delile) A. Chevalier (*A-I*). *A, C, D*, Fruits (× 1); *B*, seed in situ (× 1); *E*, seed topography (× 5); *F*, cotyledon concealing all but tip of radicle (left) and embryonic axis (right) (× 3); *G-I*, testa (× 2, × 50, × 1,000).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Genus: *Acacia* Miller.

Phylogenetic Number: 4.02.

Tribe: Acacieae.

Species Studied - Species in Genus: 70 spp. - ca. 1,200 spp.

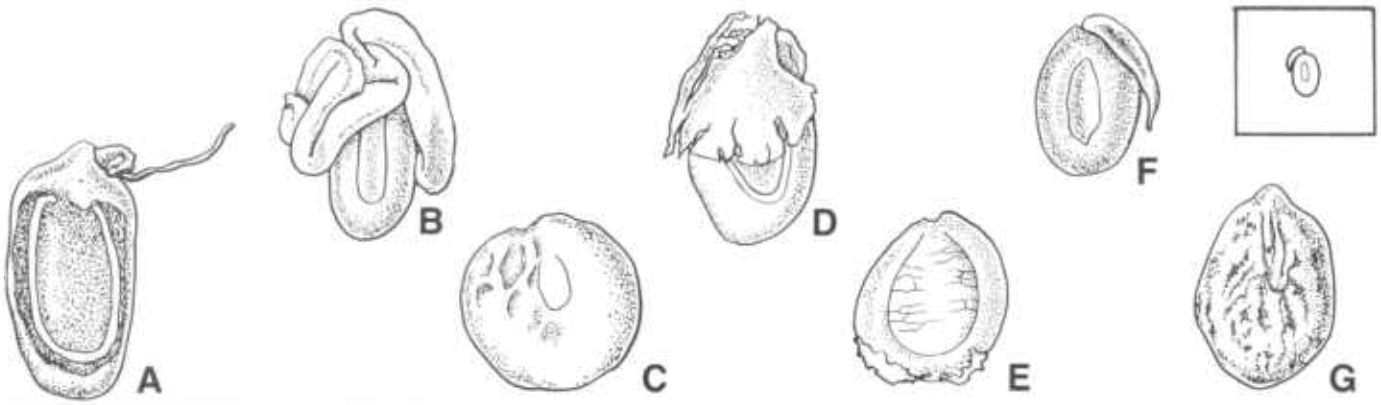
Fruit 2-30 × 0.4-5 × 0.2-2 cm, straight to many-coiled or contorted, without to with twists, oblong to linear or ovate to moniliform, margins not constricted to constricted, rounded to tapered (rarely beaked) to apex, short tapered to tapered to stipe up to 12 mm long or substipitate to nonstipitate, flattened to terete, membranous to ligneous. Valves either dehiscing medially along 1 or both sutures to tardily dehiscent or indehiscent, remaining attached to sutures (rarely winged), with or without visible seed chambers. Epicarp dull to glossy, brown (various shades or in combination with other colors) to red or black, glabrous to pubescent (composed of various types of hairs), faintly to strongly reticulate, occasionally longitudinally rugose or glandularly dotted or umbonate, not exfoliating. Mesocarp absent to present and when fresh fleshy or pulpy on drying becoming spongy to fibrous and ligneous. Endocarp dull, monochrome ocher to streaked with purple to black, occasionally chartaceous and enclosing individual seeds or mealy and packed between seeds, nonseptate to septate. Seeds 1 to numerous, transverse to parallel, not overlapping, in 1 row in dehiscent fruits and in 2-3 rows in some indehiscent fruits. Funiculus 0.5-20 mm long, filiform to thick with varying lengths if seeds in 2 or 3 series, occasionally adnate to mature seeds, curved to plicate or convoluted. Indurate and expanded funiculi best developed in Australian species are labeled arils and are clavate to foliaceous or elongate to 1-5 plicate to encircling seed 1 or more times, orange to red (or drying black) or yellow to white.

Seed 3-17 × 1.5-12 × 1-10 mm, circular to elliptic or ovate to oblong, flattened to terete. Testa glossy, brown (various shades or combined with other colors) to black or green, monochrome to mottled or streaked, with areola same shade or different shade than area outside of pleurogram or area immediately adjacent to pleurogram lighter or darker shades, smooth, osseous to coriaceous, with 75 percent to apically connected pleurogram, with or without fracture lines and aril (see funiculus), without wing. Hilum punctiform, exposed or concealed by funiculus or aril, flush and with or without halo, subapical to apical. Lens 0.1-1.1 mm, triangular to elliptic or linear, mound to pit and with or without halo, buff to darker than testa. (The lens of *A. erioloba* mimics a faboid hilum that has white lips along hilar groove.) Endosperm either present and thin to thick and adnate to testa or absent. Cotyledons auriculate over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule well developed.

Distribution: Pantropic and pansubtropic.

Notes: In the Mimosoideae, *Acacia* is one of two (the other is *Pithecellobium*) genera whose seeds may have arils. Arils in *Acacia* are highly developed, especially the Australian species, and when present are a factor in seed dispersal (Glyphis et al., *1981*). Bravato (*1974*) related the presence or absence of endosperm to three previously recognized segregate genera: *Poponax* Rafinesque with "abundant and encircling endosperm" and *Acacia* s.s. and *Senegalia* Rafinesque with "endosperm absent or scanty." The West African fruits and seeds of *Acacia* were studied and illustrated by Nongonierma (*1978, 1979*) and the South African seeds by Iksanova and Kaden (*1971*). For other recent reports, see Vassal (*1972*), Maslin (*1975*), Pettigrew and Watson (*1975*), Guinet and Vassal (*1978*), Pedley (*1978-79*), and Ross (*1979*). Ross reported that the African species had seeds that are "exendospermous."

Acacia seeds: *A. coriacea* de Candolle (*D*), *A. cyclops* A. Cunningham ex G. Don (*B*), *A. glandulifera* S. Watson (*G, L-M*), *A. grandicornuta* Gerstner (*A*), *A. harmandiana* (Pierre) Gagnepain (*E, H, J*), *A. heterophylla* Willdenow (*C*), *A. vestita* Ker-Gawler (*F, K*), *A.* spp. (*I*). *A-G*, Seed topography (× 3); *H*, seeds in situ (× 3); *I-M*, testa (× 1, × 50, × 1,000, × 1,000, × 50).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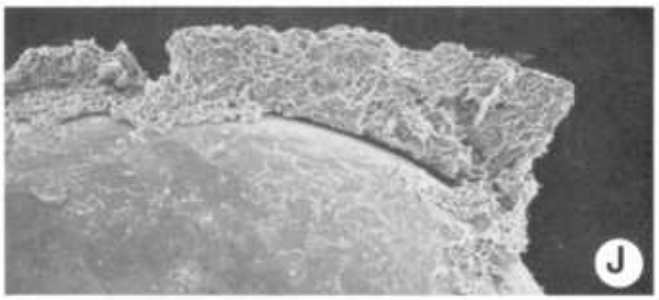
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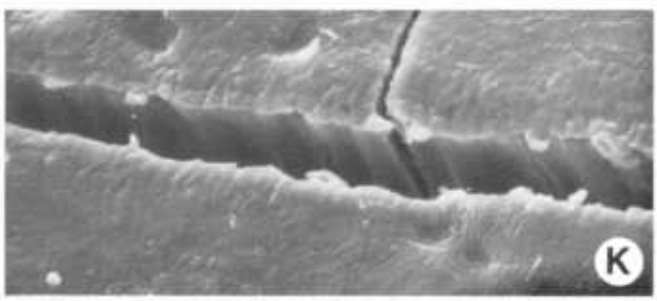
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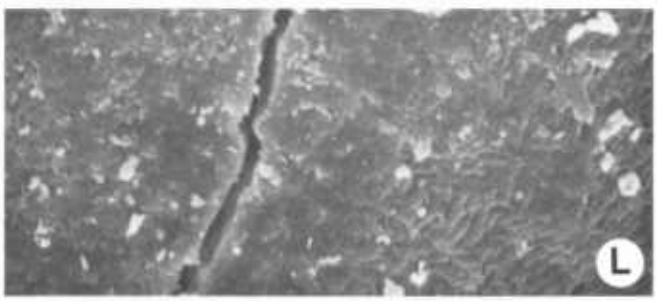
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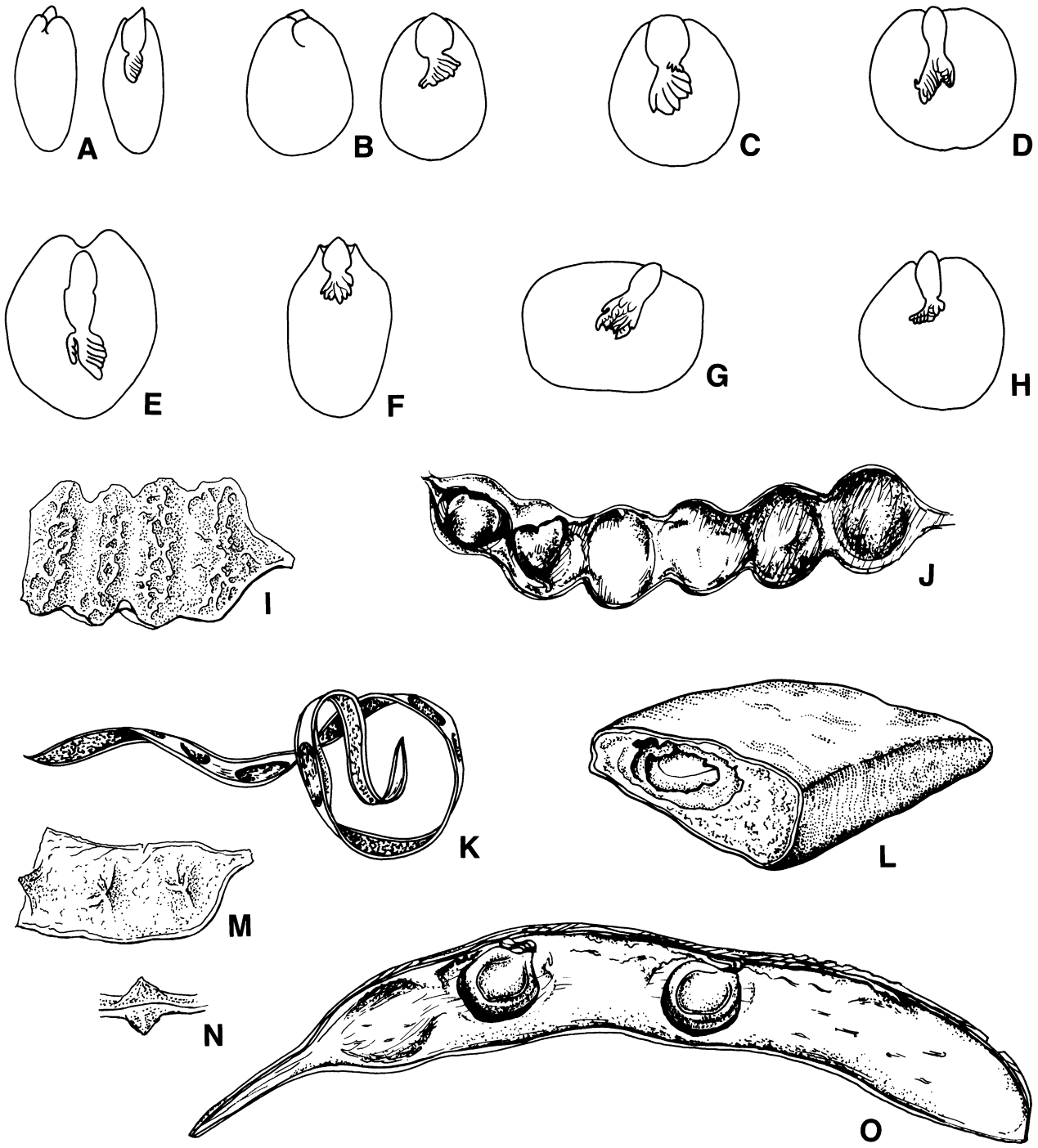
Acacia seeds and fruits: *A. berlandieri* Bentham (*G*), *A. bidwillii* Bentham (*H, O*), *A. breviracemosa* Britton & Rose (*E*), *A. concinna* de Candolle (*I*), *A. coriacea* de Candolle (*B*), *A. dealbata* Link (*F*), *A. erioloba* E. Meyer (*L*), *A. heterophylla* Willdenow (*D*), *A. implexa* Bentham (*K*), *A. kirkii* Oliver (*M-N*), *A. neriifolia* A. Cunningham ex Bentham (*A*), *A. nilotica* (Linnaeus) Willdenow ex Delile subsp. *nilotica* (*J*), *A. victoriae* Bentham (*C*). *A-B*, Cotyledons concealing all but tip of radicle (left) and embryonic axes (right) (× 3); *C-H*, embryonic axes (× 3, × 4, × 5, × 5, × 2, × 4); *I, M-N*, partial fruits (× 1); *J-L, O*, seeds in situ (× 1).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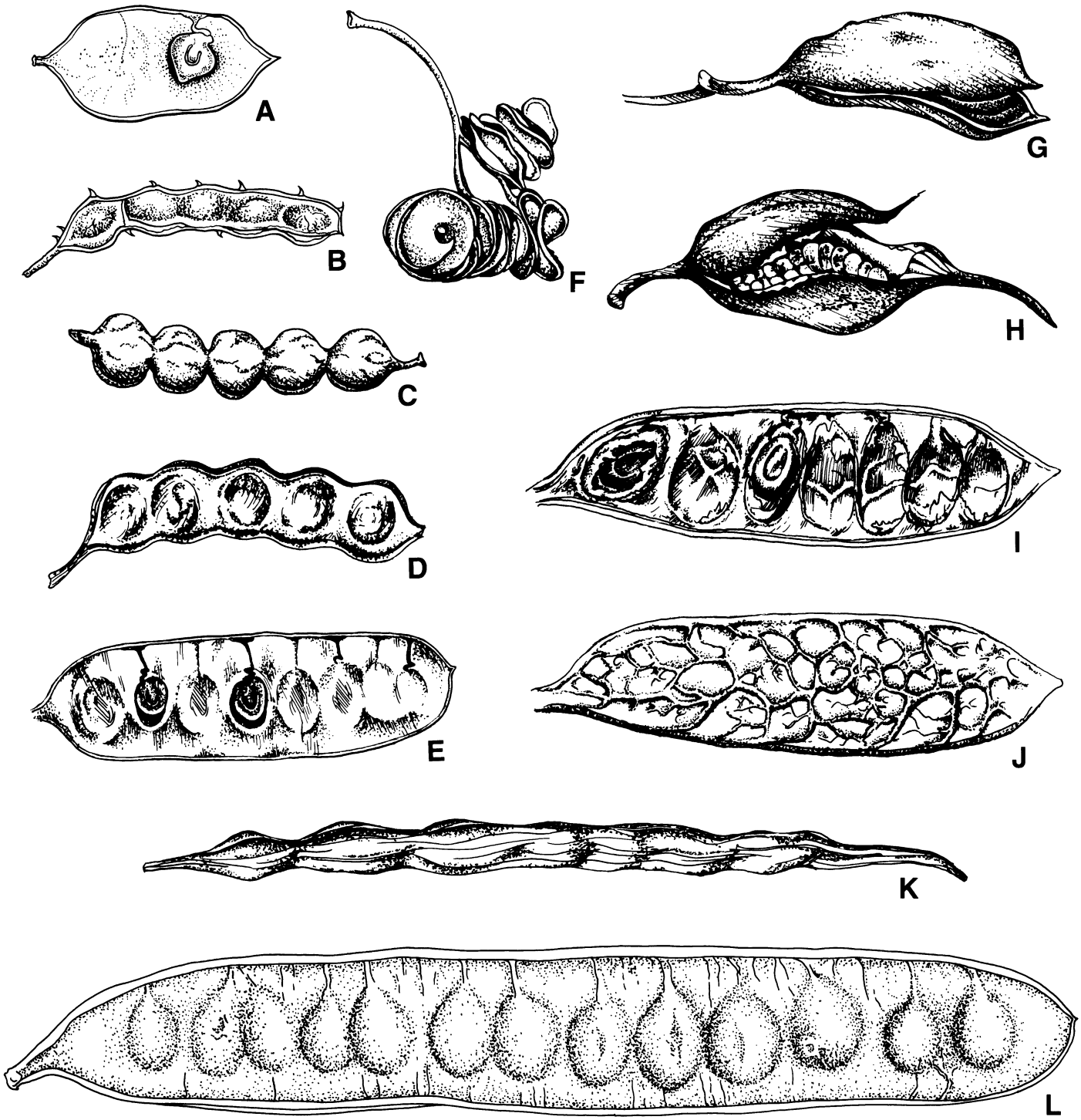
Acacia fruits: *A. aroma* Gillies (*C*), *A. choriophylla* Bentham (*G*), *A. cincinnata* F. v. Mueller (*F*), *A. cornigera* (Linnaeus) Willdenow (*H*), *A. dunnii* Turrill (*I-J*), *A. gentlei* Standley (*K*), *A. glomerosa* Bentham (*L*), *A. laeta* R. Brown ex Bentham (*A*), *A. lindheimeri* A. Gray (*B*), *A. nilotica* (Linnaeus) Willdenow ex Delile subsp. *kraussiana* (Bentham) Brenan (*D*), *A. riparia* Kunth (*E*). *A, E, I,* Seeds in situ (× 1); *B-D, F-H, J-L,* fruits (× 1).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Ingeae (5.01-5.20, Unassigned Genus and Species)

Genus: *Affonsea* A. St.-Hilaire.

Phylogenetic Number: 5.01.

Tribe: Ingeae.

Species Studied - Species in Genus: 2 spp. - 14 spp.

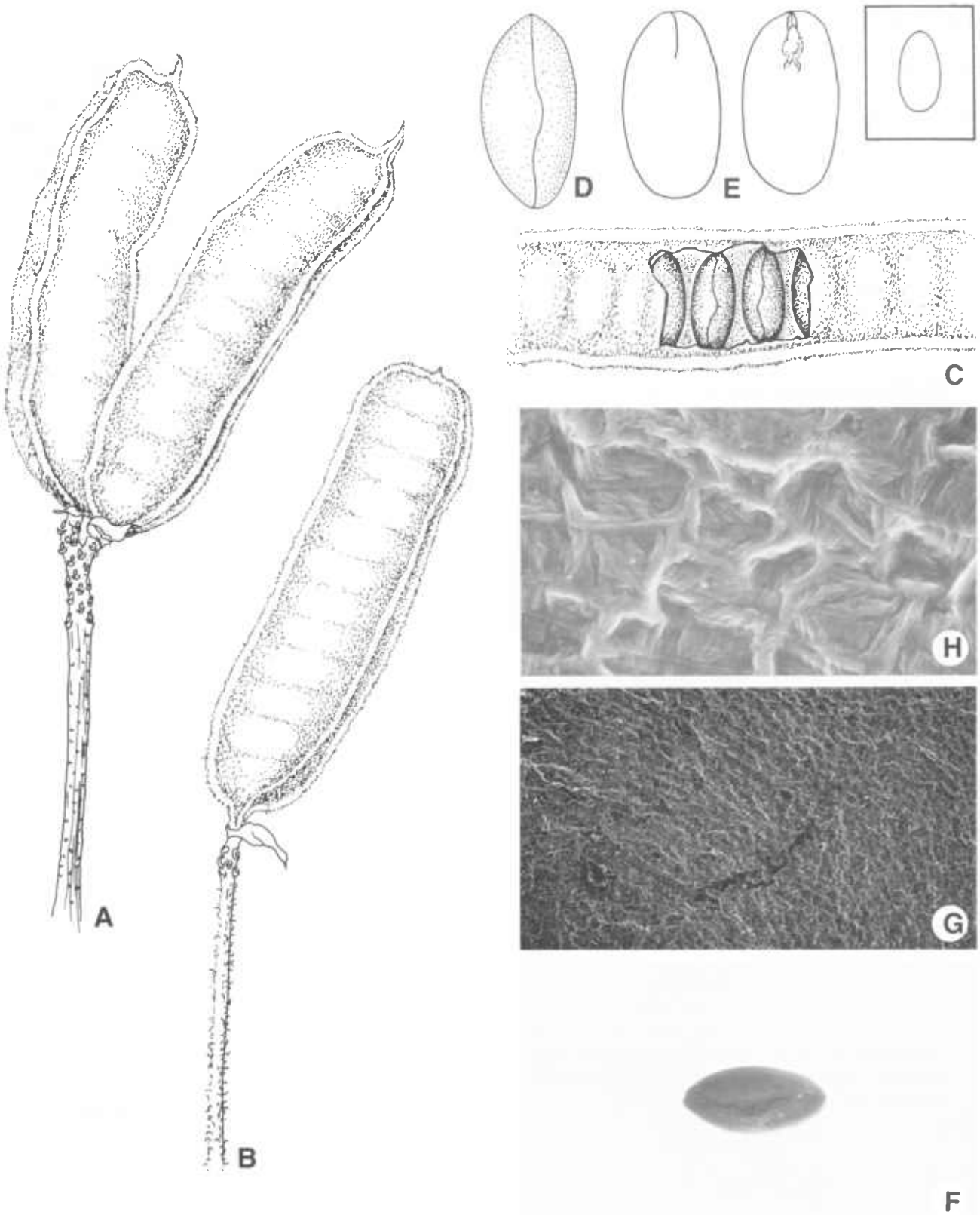
Fruit 8-13 × 2-2.5 × 0.7-0.9 cm, straight to slightly curved, with twists, oblong, margins not constricted, rounded to apex, rounded to base, substipitate, compressed, ligneous. Valves indehiscent, remaining attached to sutures, with visible seed chambers. Epicarp dull, reddish brown because of dense pubescence, dark brown and shagreen after hairs fall, not exfoliating. Mesocarp fibrous, ligneous. Endocarp dull, tan, encasing individual seeds or not, septate to subseptate. Seeds 12-14, transverse, not overlapping, in 1 series. Funiculus 1-2 mm long, thick, triangular.

Seed 12-14 × 6.5-8 × 6-7 mm, oblong, compressed. Testa either absent from mature embryos or present and dull, brown, shagreen, coriaceous, without pleurogram or fracture lines or wing or aril. Hilum punctiform, exposed, flush, subapical. Lens not discernible. Endosperm absent. Cotyledons with simple split over radicle, concealing radicle. Embryonic axis straight. Plumule moderately developed.

Distribution: East Brazil.

Notes: Vinha (*1981*) monographed the species of southern Bahia, Brazil, and recognized 14 species, 6 new. He saw no fruits of the new species. Nielsen (*1981a*) recognized seven species. More seeds and fruits should be collected and distributed to herbaria. Most seeds in herbaria are bruchid damaged.

Affonsea: A. bullata Bentham (*B, E-H*), *A. densiflora* Bentham (*A, C-D*). *A-B*, Fruits (× 1); *C*, embryos in situ (× 1); *D*, embryo (× 2); *E*, cotyledon concealing radicle (left) and embryonic axis (right) (× 2); *F-H*, cotyledon surface (× 2, × 50, × 1,000).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Genus: *Inga* Scopoli.

Phylogenetic Number: 5.02.

Tribe: Ingeae.

Species Studied - Species in Genus: 27 spp. - ca. 350 spp.

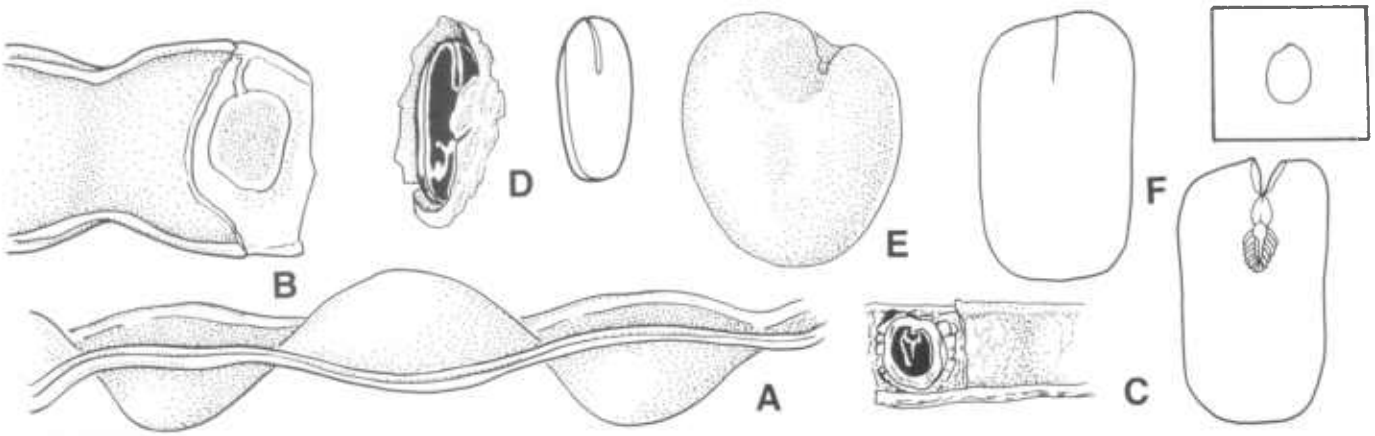
Fruit 1.5-65 × 1-8.5 × 0.8-3 cm, straight to 2-coiled, without or with twists, linear to oblong or ovate, margins not constricted to constricted, rounded to short tapered to apex, rounded to stipe 5-20 mm long or nonstipitate, compressed to flattened or rarely subterete or quadrangular, coriaceous to ligneous. Valves indehiscent to scarcely opening or bursting irregularly, with or without ribs (many ribbed in *I. edulis*) or sunken and sutures enlarged creating winglike margins, remaining attached to sutures, with or without visible seed chamber. Epicarp dull to glossy, brown, glabrous to densely pubescent with short to long reddish to brownish or yellowish hairs and often becoming glabrate with age, reticulate or rarely longitudinally venose, not exfoliating. Mesocarp fibrous, ligneous. Endocarp dull, brown, remaining within fruit or falling free with seed as white sweet pulp and serving or not as surrogate testa, nonseptate to septate. Seeds 2-21, transverse to parallel, not overlapping, in 1 series. Funiculus 1-9 mm long, thick to filiform, curved to straight.

Seed 12-26 × 9-16 × 2-16 mm, oblong, compressed to flattened. Testa either remaining attached to endocarp with embryo falling free or remaining attached to embryo and falling free of endocarp, dull, brown to black, smooth to shagreen, with or without endocarp remnants, coriaceous to osseous, without pleurogram or fracture lines or wing or aril. Hilum punctiform, exposed, flush to recessed, apical. Lens 1.1-3 mm, elliptic, mound, tan to buff (based on *I. affinis*). Endosperm absent. Cotyledons with simple split or entire over radicle, concealing radicle or all but tip of radicle. Embryonic axis straight. Plumule rudimentary to well developed and pubescent.

Distribution: Tropical and subtropical America.

Notes: Pittier (*1914-1917*) monographed the genus. Bravato (*1974*) described *I. coriacea* (Persoon) Desvaux seeds as polyembryonic with irregular lobulate cotyledons tightly encrusted one with the other. Several authors mistakenly noted that the aril becomes a surrogate testa and correctly noted that the seeds germinate through the rotting fruits. The aril is really the white, sweet, pulpy endocarp, which may serve as a surrogate testa.

Inga seeds and fruits: *I. affinis* de Candolle (*I-K*), *I. alba* (Sweet) Willdenow (*C, E, G, L*), *I. capitata* Desvaux (*A-B*), *I. ingoides* (A. Richards) Willdenow (*F*), *I. nobilis* Willdenow (*D*), *I.* spp. (*H*). *A*, Partial fruit (× 1); *B-C*, embryo in situ (× 1); *D*, embryo within 1-seeded endocarp segment (left) and cotyledons (right) (× 1); *E*, seed topography (× 4); *F*, cotyledons concealing radicle (left) and embryonic axis (right) (× 4); *G-H, J-K*, testa (× 1, × 1, × 50, ×1,000); *I*, seed in transection (left) and testa (right) (× 1); *L*, cotyledon surface (× 1,000).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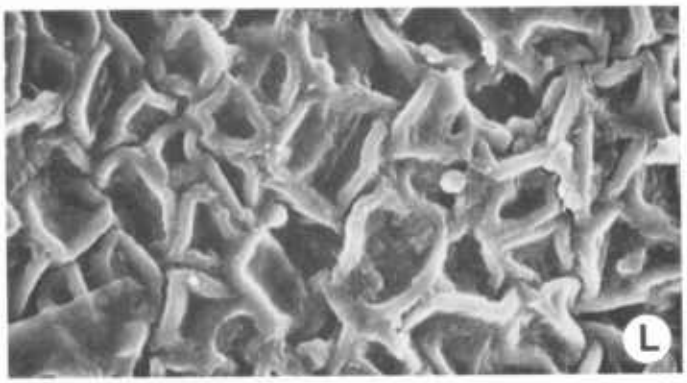
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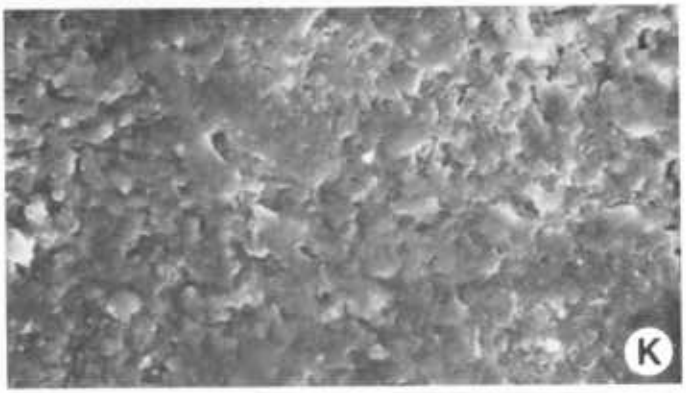
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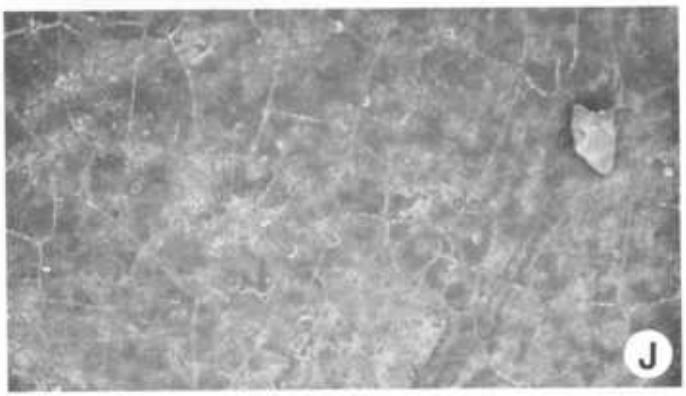
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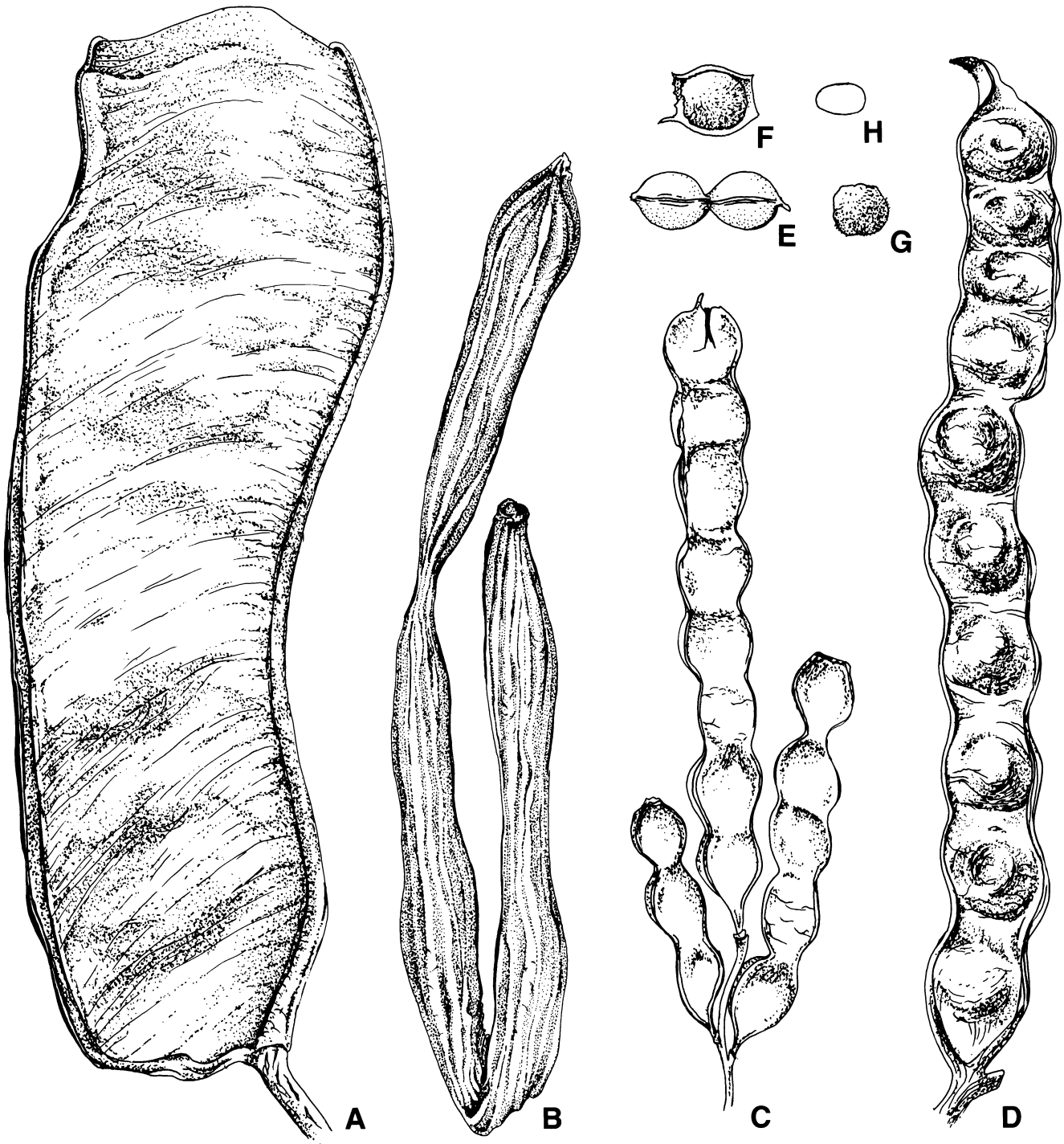
Inga fruits: *I. edulis* Martius (*B*), *I. fagifolia* Willdenow ex Bentham (*D*), *I. marginata* Willdenow (*C, E-H*), *I. nobilis* Willdenow (*A*). *A*, Fruit (× 1); *B*, fruit (× 0.5); *C*, fruit cluster (× 1); *D*, fruit (× 1); *E*, fruit segment (× 1); *F*, free endocarp containing 1 seed in situ (× 1); *G*, free endocarp containing 1 seed (× 1); *H*, seed outline (× 1).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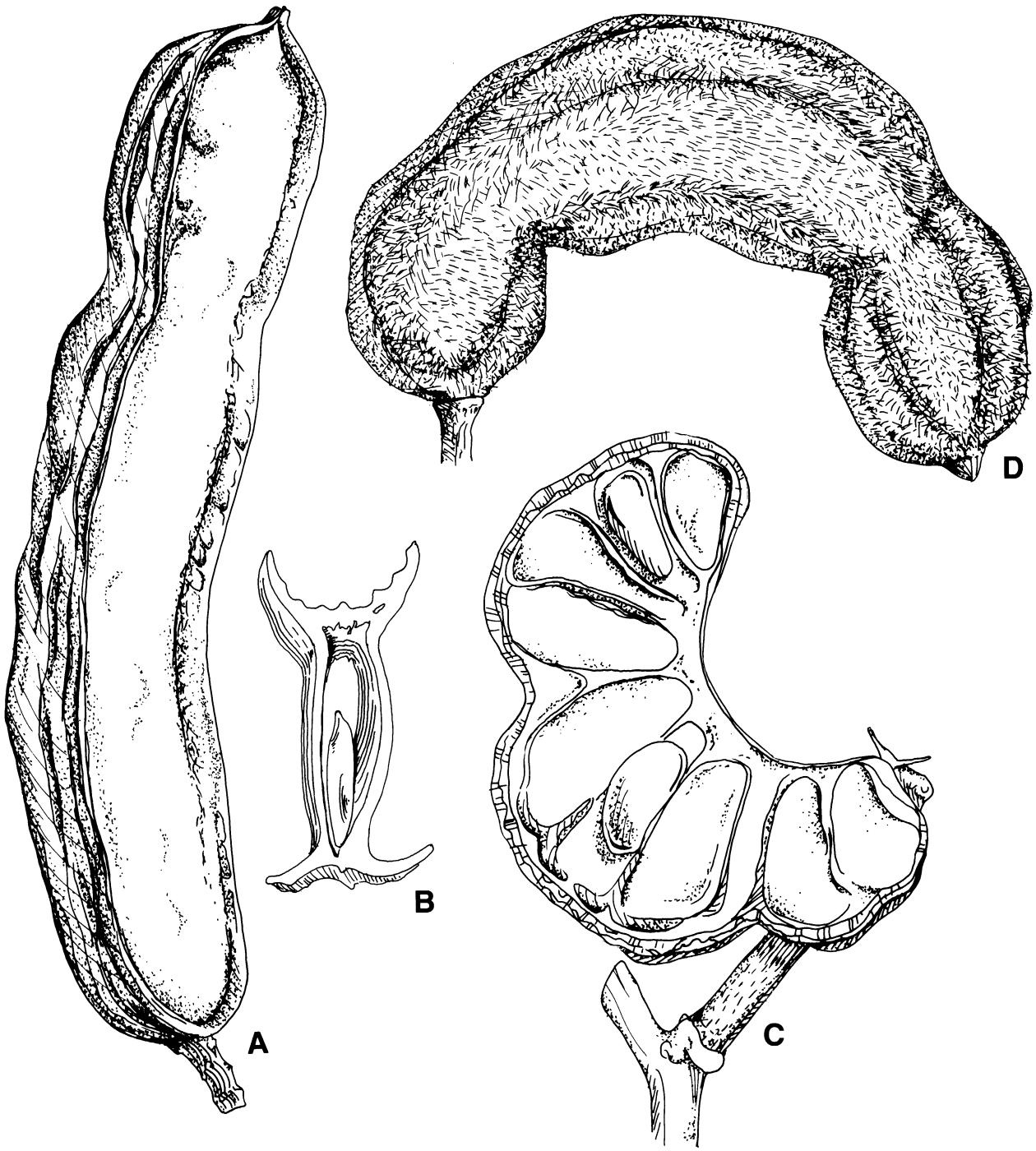
Inga fruits (con.): *I. panamensis* Seemann (*A-B*), *I. sessilis* (Vellozo) Martius (*D*), *I. spectabilis* (Vahl) Willdenow (*C*). *A, D,* Fruits (× 1); *B,* transection of fruit showing seed (× 1); *C,* seeds in situ (× 1).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Genus: *Abarema* Pittier.

Phylogenetic Number: 5.03.

Tribe: Ingeae.

Group: Albizia.

Species Studied - Species in Genus: 2 spp. - ca. 20 spp.

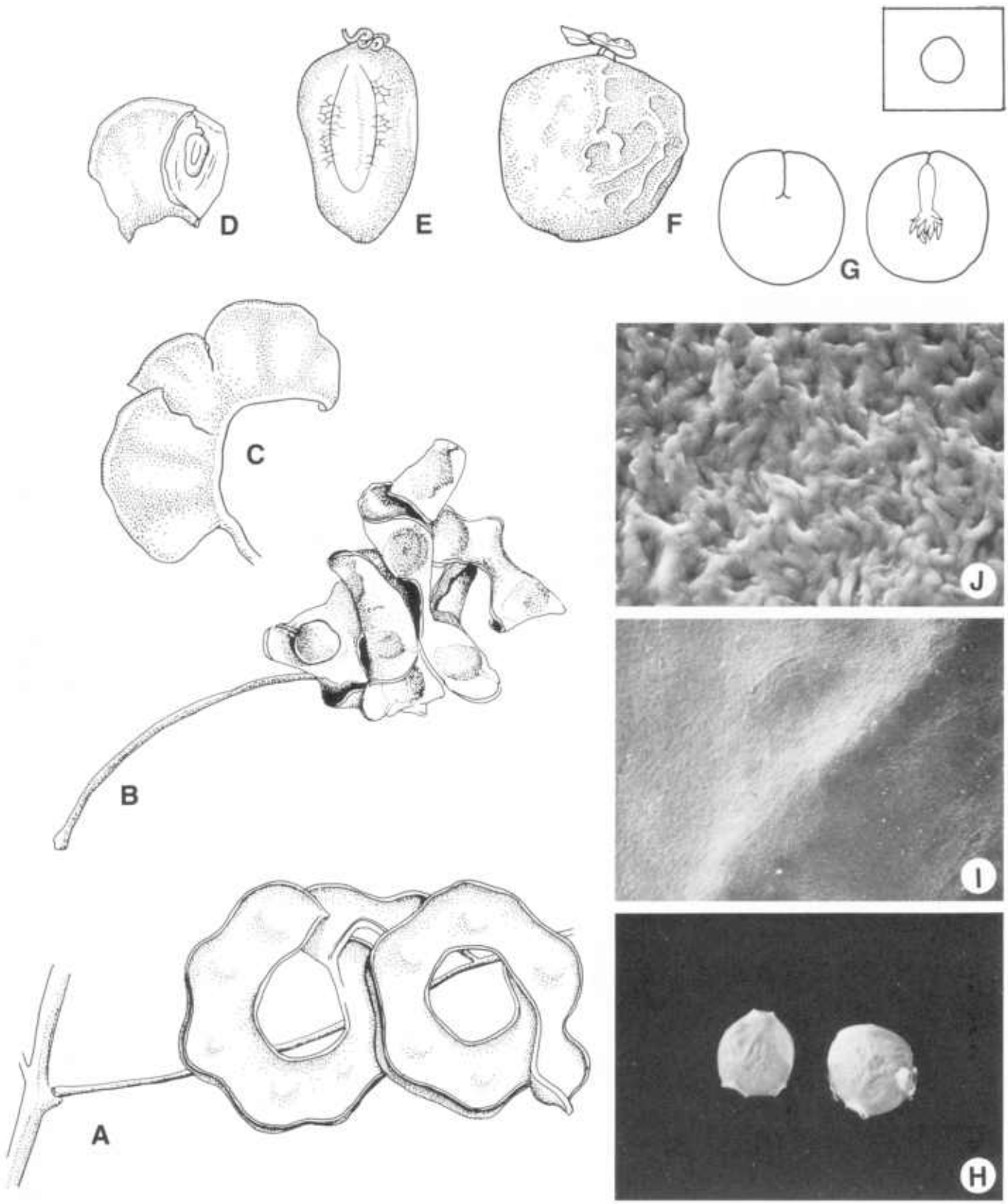
Fruit 5-13 × 0.4-2 ×0.5 cm, curved to 1 or more coiled, with or without twists, linear, margins constricted to not constricted, rounded to short tapered to apex, short tapered to rounded to base, nonstipitate, compressed, coriaceous. Valves dehiscing apically along both sutures and reflexing along ventral margin and eventually twisting either separately or together, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown to blackish brown, puberulent to glabrous, reticulate, not exfoliating. Mesocarp fibrous, ligneous. Endocarp dull, reddish brown to brown, nonseptate to septate. Seeds 5-10, transverse, not overlapping, in 1 series. Funiculus at least to 5 mm long, thick, plicate.

Seed 5.7-7.5 × 5.7-7 × 3-6 mm, circular to elliptic or ovate, subterete. Testa glossy, brown to blue or whitish, smooth to rugose, coriaceous to osseous, with or without 90 percent pleurogram and fracture lines, without wing and aril. Hilum punctiform, exposed, flush, subapical. Lens not discernible. Endosperm either absent in *A. jupunba* or present and thin and adnate to testa in *A. trapezifolia*. Cotyledons with simple split over radicle, concealing radicle, blue green and for seeds with whitish testa blue green and tan on intercotyledon faces adjacent to radicle. Embryonic axis straight. Plumule well developed.

Distribution: Central and South America.

Notes: Based on only 2 of a possible 20 species in the genus, *Abarema* is heterogeneous from a seed topography standpoint and homogeneous from a fruit topography standpoint. More seeds and fruits should be collected and studied. *Abarema* spp. may be curated with *Pithecellobium,* 5.08.

Abarema: A. jupunba (Willdenow) Britton & Killip (*A-B, F-J*), *A. trapezifolia* (Bentham) Pittier (*C-E*). *A*, Fruit cluster (× 1); *B*, dehiscent fruit (× 1); *C*, single fruit (× 1); *D*, seed in situ (× 1); *E-F*, seed topography (× 4); *G*, cotyledon concealing radicle (left) and embryonic axis (right) (× 3); *H-J*, testa (× 2, × 50, × 1,000).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Genus: *Albizia* Durazzini.

Phylogenetic Number: 5.04.

Tribe: Ingeae.

Group: Albizia.

Species Studied - Species in Genus: 33 spp. - ca. 150 spp.

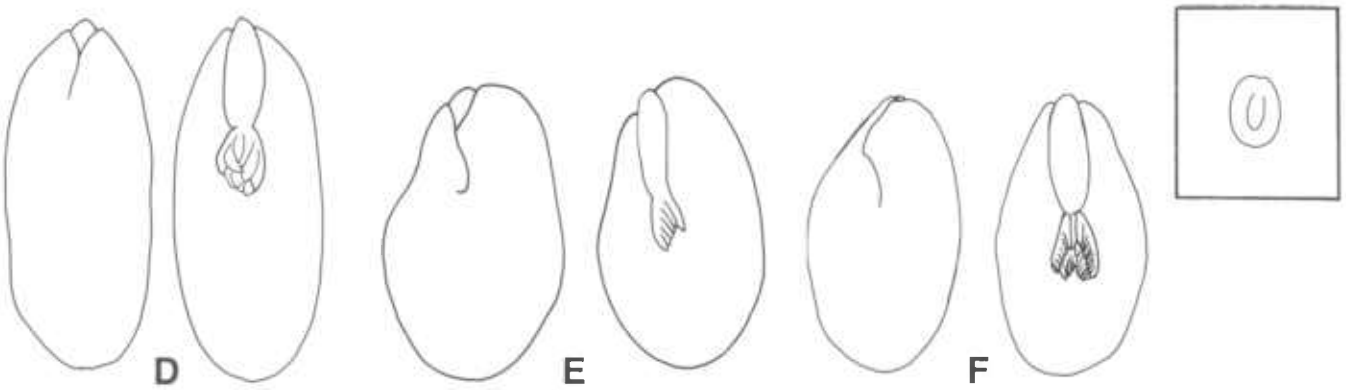
Fruit 5-36 × 0.5-7 × 0.1-0.5 cm, straight to 1-coiled, without or with slight twists, broadly linear to oblong, margins not constricted to constricted along both margins or dorsal margin, rounded to short tapered or truncate or beaked to apex, short tapered to stipe up to 20 mm long or substipitate to nonstipitate, compressed to flattened, coriaceous to chartaceous or subligneous. Valves either dehiscing medially along ventral margin and reflexing to tardily dehiscent or indehiscent and remaining entire to breaking through sutures into 1-seeded segments or occasionally breaking irregularly or falling from replum, remaining attached to sutures (rarely with 1-3 mm wide wings), with visible seed chambers. Epicarp dull to glossy brown to reddish purple or yellowish brown, glabrous to pubescent, reticulate and with or without prominent transverse parallel veins, not exfoliating. Mesocarp either absent or present and poorly developed. Endocarp dull, white to ocher, septate to nonseptate. Seeds 4-25, transverse, not overlapping, in 1 series. Funiculus up to 15 mm long, filiform to thick, curved to spirally coiled or plicate.

Seed 3-17 × 2-15 × 1.5 mm, circular to ovate or elliptic or oblong, compressed to flattened. Testa glossy, ivory to olive or brown to black, monochrome to mottled, smooth, coriaceous to osseous, with 90 percent pleurogram, with or without fracture lines, without wing and aril. Hilum punctiform, exposed or concealed by funiculus or funicular remnant, recessed and with or without dark halo, subapical to marginal in relation to seed length but not to embryonic axis. Lens 1-5 mm long, elliptic to linear, mound to flush and either within halo or halo absent, buff. Endospem either absent or present, thin and adnate to testa. Cotyledons with basally groined or simple split over radicle, concealing radicle or all but tip of radicle, may be of 2 lengths within 1 seed. Embryonic axis straight to slightly deflexed. Plumule well developed.

Distribution: Pantropic and pansubtropic.

Notes: *Albizia* section Lophantha series Pachyspermae is now *Paraserianthes,* 5.10. Nielsen (pers. commun., 1982) has not transferred *Cathormion umbellatum* (Vahl) Kostermans because it "may be the only true *Cathormion.*" At this time he does not recognize the genus *Cathormion.* Isley (*1973*) described fruits of *A. saman* Jacquin as bearing "light line on each side of the black sutures." His is the third distinct use of "light line" in describing legume fruits and seeds. Nielsen (*1979b*) in a study of the *Albizia* spp. of mainland southeastern Asia diagramed their seeds and presented a fruit-plant key.

Albizia seeds: *A. acle* Merrill (*D*), *A. caribaea* Urban (*B, F*), *A. chinensis* (Osbeck) Merrill (*A*), *A. guachpele* (Kunth) Dugand (*E, J*), *A. leptophylla* Harms (*C*), *A. saman* F. v. Mueller (*H-I*), *A.* spp. (*G*). *A-C*, Seed topography (× 3) and *D* (× 2); *E-F,* cotyledons concealing or concealing all but tip of radicle (left) and embryonic axes (right) (× 3); *G-J*, testa (× 2, × 50, × 1,000, × 1,000).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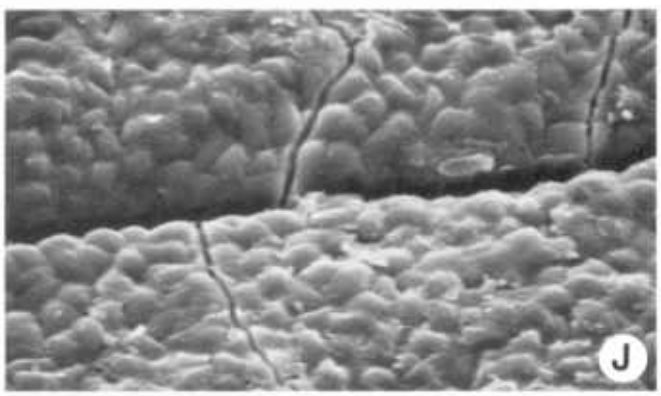
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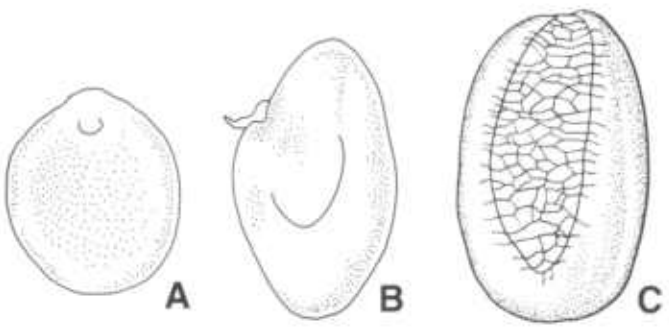
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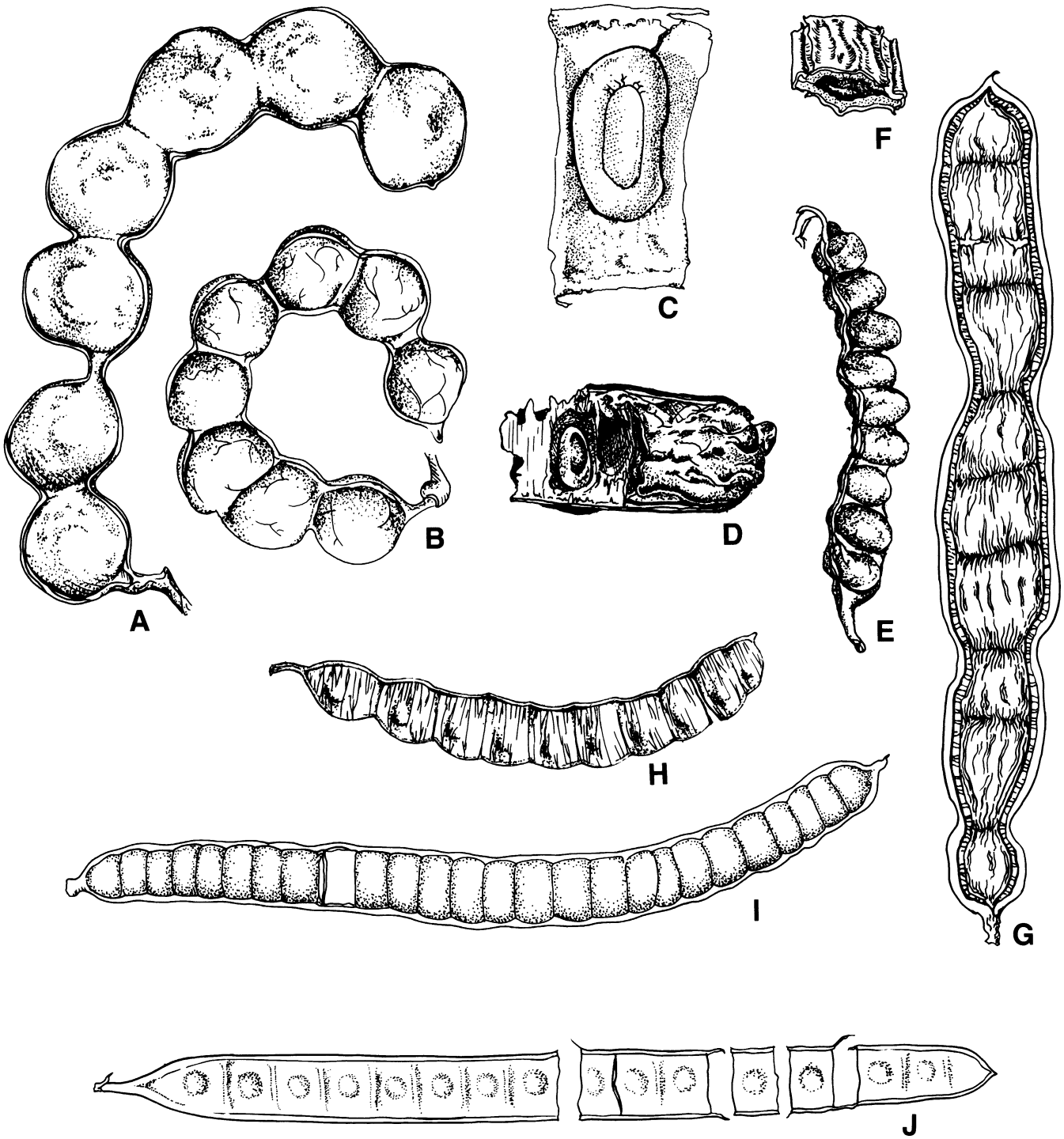
Albizia fruits: *A. altissima* Hooker (*B*), *A. berteriana* (Balbis ex de Candolle) Gomez de la Maza (*J*), *A. leptophylla* Harms (*E, I*), *A. obliquefoliolatum* de Wildeman (*C, H*), *A. saman* F. v. Mueller (*D, F-G*), *Cathormion umbellatum* (Vahl) Kostermans (*A*). *A-B, E, G-I,* Fruits (× 1); *C-D,* seeds in situ (× 3, × 1); *F,* fruit segment (× 1); *J,* fruit with segments missing.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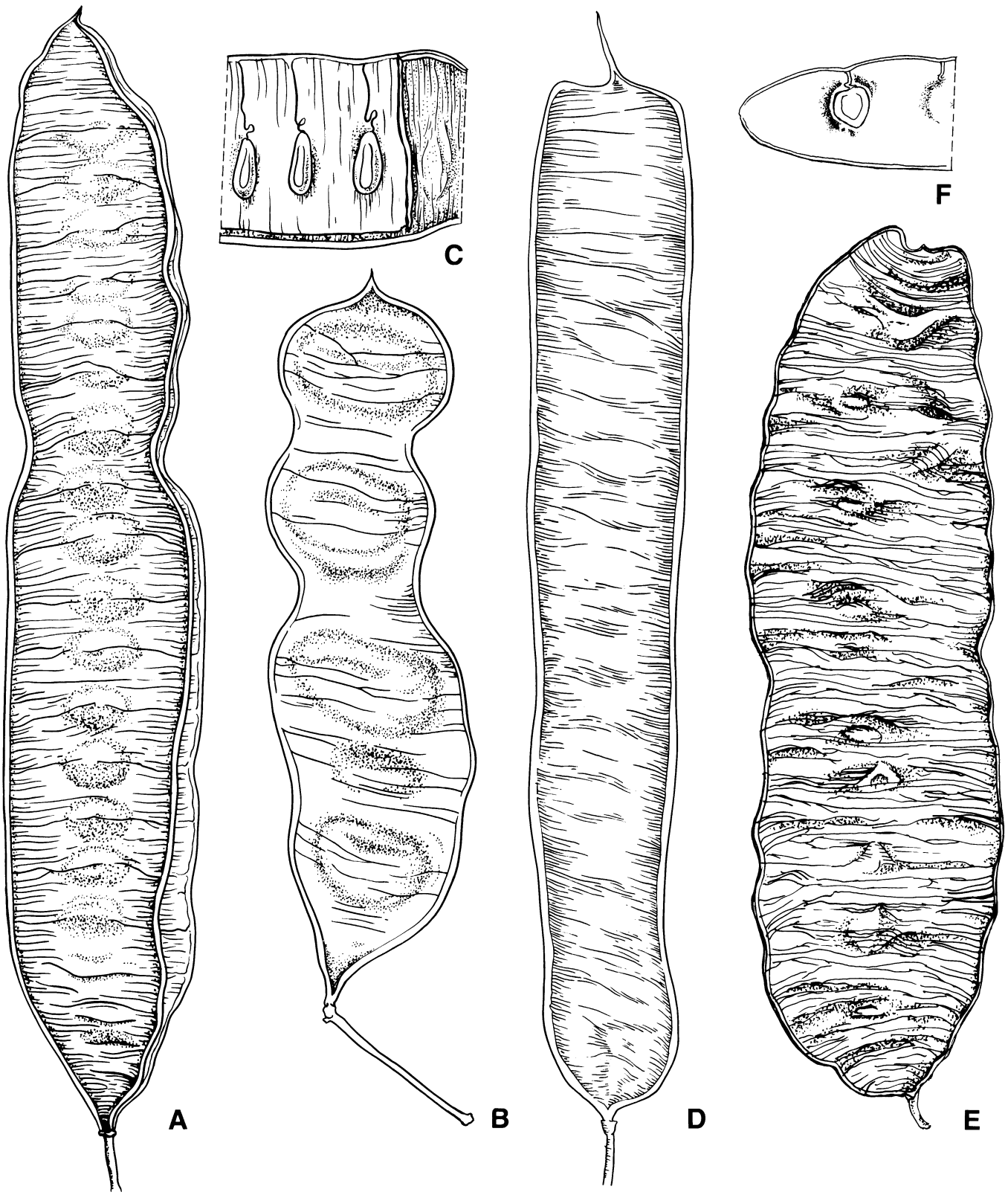
Albizia fruits (con.): *A. bernieri* Fournier (*B*), *A. guachpele* (Kunth) Dugand (*A, C, E*), *A. gummifera* (J. F. Gmelin) A. C. Smith (*F*), *A. longipedata* (Pittier) Britton & Rose ex Record (*D*). *A*, Dehiscent fruit (× 1); *B*, fruit (× 1); *C, F,* seeds in situ (× 1); *D-E*, fruits (× 1).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Genus: *Lysiloma* Bentham.

Phylogenetic Number: 5.05.

Tribe: Ingeae.

Species Studied - Species in Genus: 14 spp. - ca. 35 spp.

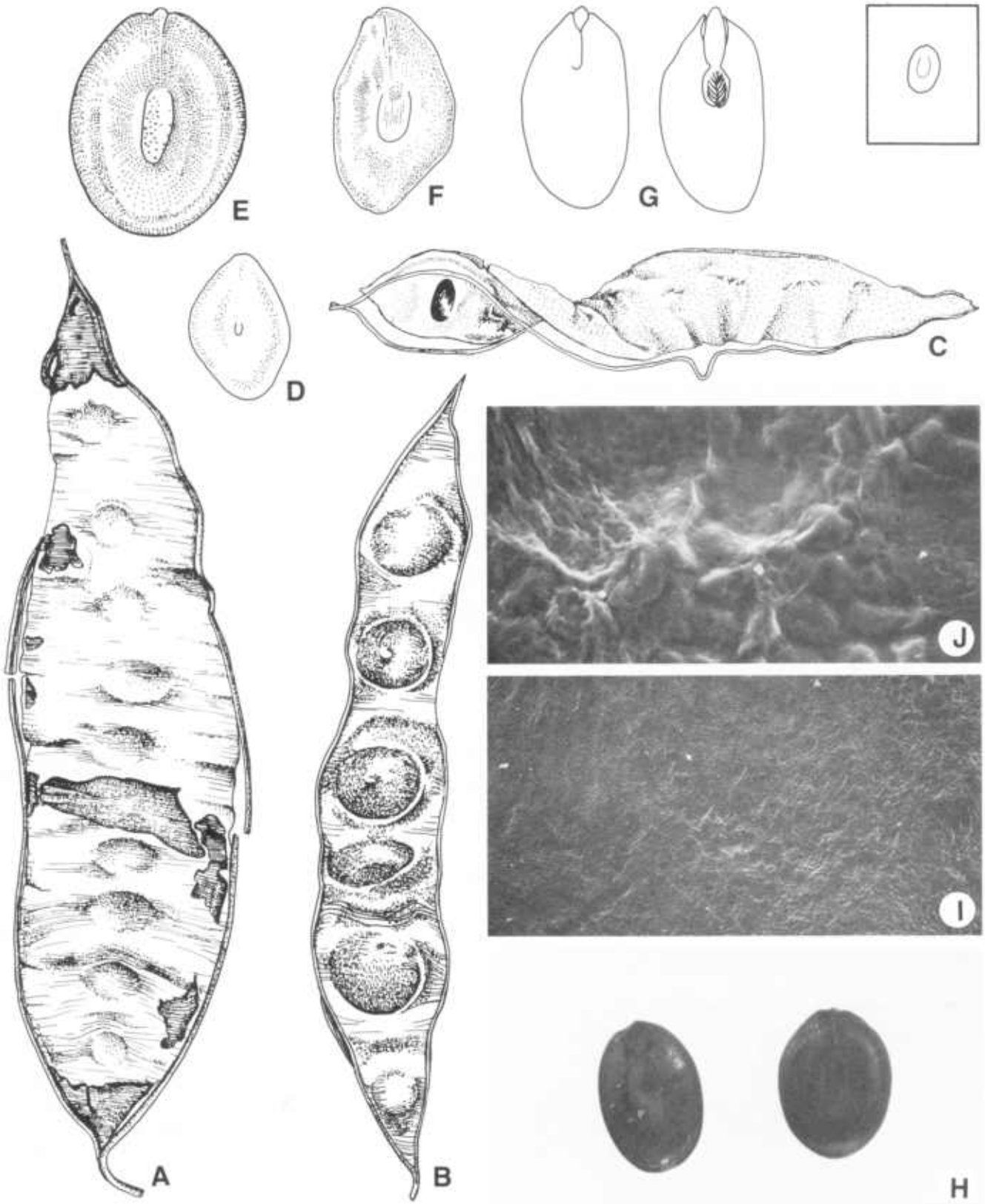
Fruit 10-25 × 1-5.5 × 0.02-0.5 cm, straight or nearly so, with or without basal twist, linear to oblong, margin not constricted, rounded to tapered to apex, short tapered to tapered or rounded to stipe up to 40 mm long or substipitate, flattened, subcoriaceous to membranous. Valves tardily dehiscent by breaking from replum thus opening though not falling away, with visible seed chambers. Epicarp dull to glossy, brown to blackish brown, glabrous to pubescent, parallel transverse veins extending either across valve or to center of valve, checking and exfoliating. Mesocarp absent. Endocarp dull, monochrome ocher or mottled with purple and with darker seed chambers, septate. Seeds 2-16, transverse, not overlapping, in 1 series. Funiculus 2.5-20.5 mm long, filiform, hooked.

Seed 5.3-10 × 3.8-6.5 × 1-2 mm, oblong to ovate, compressed to flattened. Testa glossy, brown, smooth, osseous to coriaceous, with 75 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, exposed to concealed by funicular remnant, flush, subapical to apical. Lens 0.1 mm long, linear, mound within hilar depression, whitish. Endosperm either present and thin and adnate to testa or absent. Cotyledons with basally groined split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule well developed.

Distribution: Tropical America, West Indies.

Notes: *Lysiloma* fruits are unusual because the entire valves break from the replum, thus opening though not falling apart.

Lysiloma: L. affinis Britton & Rose (*C-D, F-G*), *L. aurita* (Schlechter) Bentham (*A*), *L. demostachys* Bentham (*I-J*), *L. watsonii* Rose (*B, E*), *L.* spp. (*H*). *A-B*, Fruits (× 1); *C*, valve with seed in situ (× 1); *D-F*, seed topography (× 4); *G*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 4); *H-J*, testa (× 3, × 50, × 1,000).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Genus: *Enterolobium* Martius.

Phylogenetic Number: 5.06.

Tribe: Ingeae.

Species Studied - Species in Genus: 4 spp. - 5 spp.

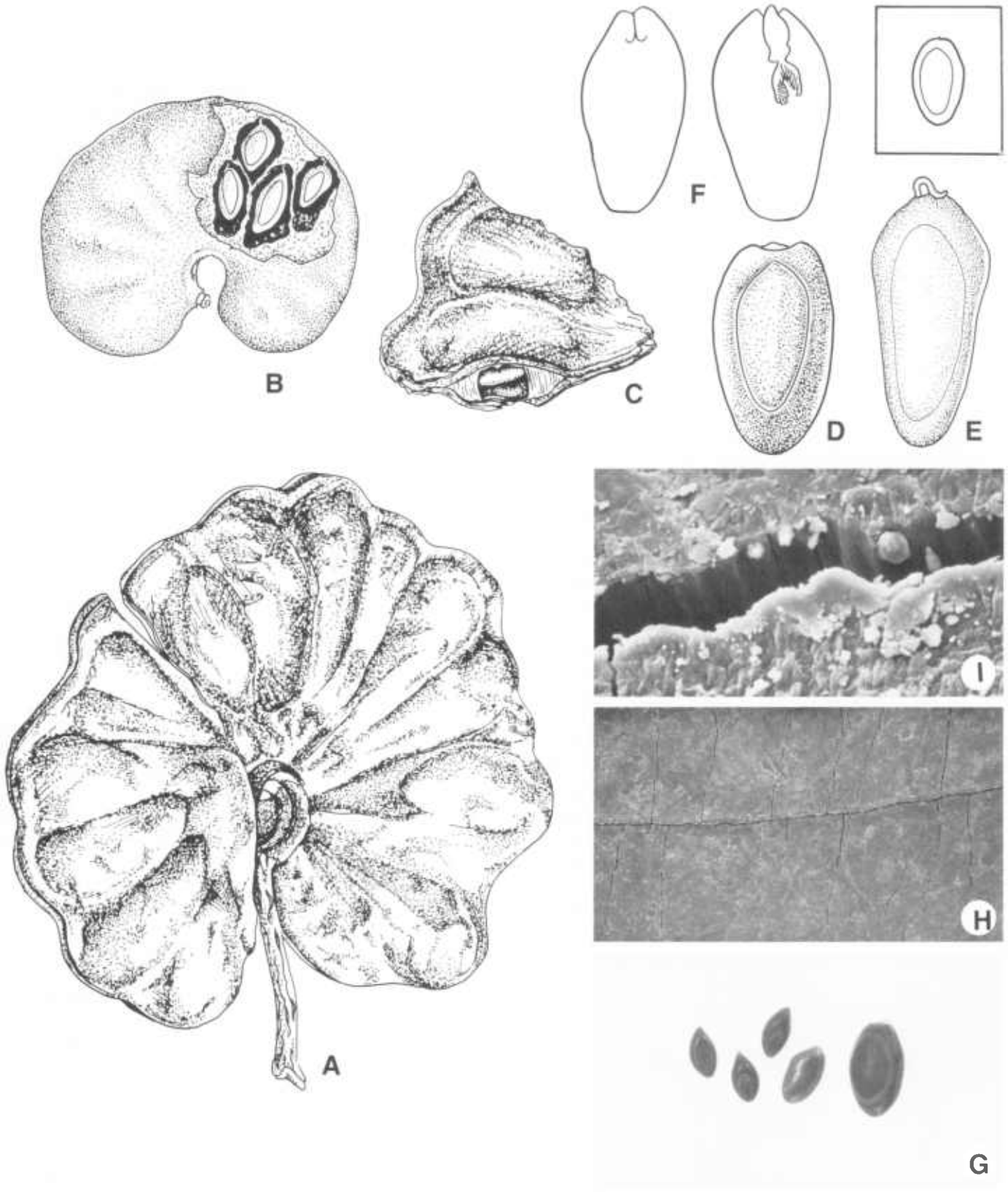
Fruit 6-17 × 2-9 × 0.7-2 cm, 1- to 1½-coiled, without twists, oblong, ventral margin slightly constricted and dorsal margin not constricted, rounded to apex, rounded to base, nonstipitate, compressed, succulent and becoming ligneous upon drying. Valves indehiscent, remaining attached to sutures, with visible to faintly visible seed chambers. Epicarp dull to glossy, black to reddish brown, glabrous, smooth to shagreen, not exfoliating. Mesocarp dull to nearly glossy, brown, septate. Endocarp dull to glossy, brown, septate. Seeds 5-14, transverse, not overlapping, in 1 or if 2 series then with alternately longer and shorter funiculi. Funiculus up to 20 mm long (alternately longer and shorter to accommodate 2 rows of seeds), thick, plicate to coiled.

Seed 9-23 × 3.5-15 × 3-9.5 mm, elliptic to indented on each side and appearing squeezed (due to pressure of adjacent seeds), compressed to terete. Testa glossy, reddish brown, monochrome to dichrome with lighter colored pleurogram and adjacent testa, smooth, osseous (with tendency to shatter), with 100 percent pleurogram, without fracture lines or wing or aril. Hilum punctiform, concealed by funiculus or remnant, flush, apical. Lens 0.3-1 mm, ovate to elliptic or irregular, mound, yellowish. Endosperm absent. Cotyledons with basally groined split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed.

Distribution: West Indies, Central and South America.

Notes: *Enterolobium* fruits are unusual in the subfamily, especially those fruits with seeds in two series (*B*).

Enterolobium: E. contortisiliquum (Vellozo) Morong (*B, E*), *E. cyclocarpa* (Sweet) Grisebach (*A, C-D, F, H-I*), *E.* spp. (*G*). *A*, Fruit (× 1); *B*, fruit with seeds in situ (× 1); *C*, partial fruit (× 1); *D-E*, seed topography (× 2, × 4); *F*, cotyledons concealing radicle (right) and embryonic axis (left) (× 2); *G-I*, testa (× 1, × 50, × 1,000).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Genus: *Calliandra* Bentham.

Phylogenetic Number: 5.07.

Tribe: Ingeae.

Species Studied - Species in Genus: 28 spp. - ca. 200 spp.

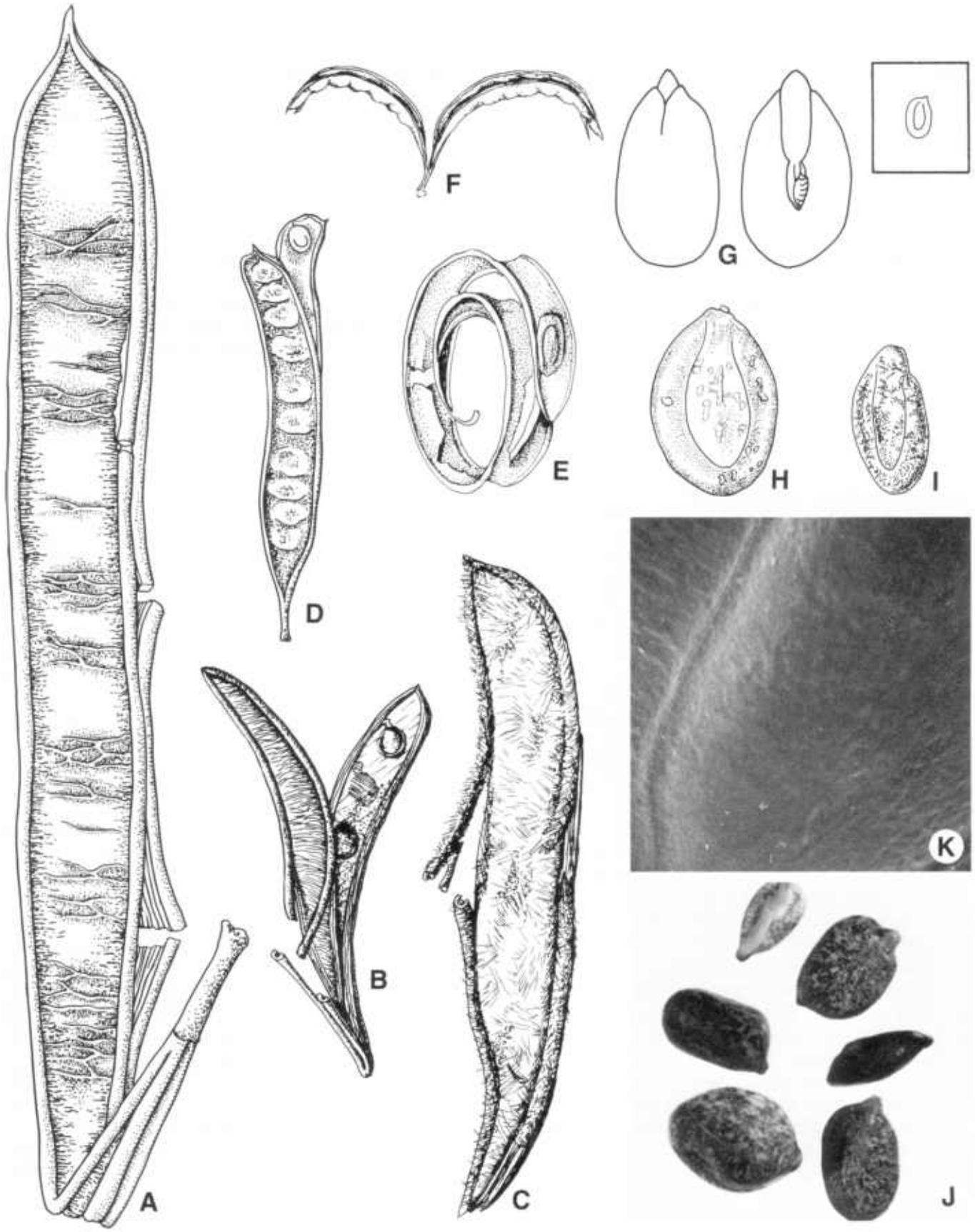
Fruit 0.3-27 × 0.2-2.5 × 0.3-0.8 cm, straight or near so, without twists, linear to oblanceolate, margins not constricted, rounded to short tapered to beaked apex, long tapered to stipe 10-20 mm long, compressed, ligneous to coriaceous or membranous. Valves dehiscing apically or basally along both margins and elastically recurving to revolute with breakage including sutures (occasionally remaining attached at center), usually remaining attached to thick sutures that occasionally are wider than valves, with faintly visible seed chambers. Epicarp dull, brown to black, pubescent to glabrous, reticulate, not exfoliating. Mesocarp absent or present and spongy. Endocarp dull, tan to ocher and monochrome to mottled, subseptate. Seeds 2-14, parallel to transverse, not overlapping, in 1 series. Funiculus 1-4 mm long, thick, straight to S-curved or hooked.

Seed 4-12 × 3-12 × 2-8 mm, circular to ovate or oblong to rhomboid, compressed. Testa dull to glossy, brown to reddish brown or black, monochrome to dichrome or mottled, smooth to rugose to shallowly pitted, coriaceous to osseous, with or without 75 percent to apically connected pleurogram, without fracture lines or wing or aril. Hilum punctiform, concealed by funicular remnant or exposed, flush, subapical to apical. Lens either not discernible or discernible and 0.2-0.6 mm long, elliptic to linear, mound, whitish. Endosperm absent (or scanty, Bravato, *1974*). Cotyledons with simple split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule well developed.

Distribution: Central and South America, Madagascar, eastern and South Africa, India.

Notes: G. P. Lewis (pers. commun., 1981) provided the African distribution. Paul (*1979*) studied the species of *Calliandra* in India, and Renvoize (*1981*) studied the species in Bahia, Brazil. Unlike most other mimosoid genera, the dehiscing mechanism is the thickened sutures and not the fibrous mesocarp.

Calliandra: C. alternans Bentham (*E*), *C. carbonaria* Bentham (*A*), *C. confusa* Sprague ex Riley (*H*), *C. eriophylla* Bentham (*G, I*), *C. houstoni* Bentham (*C*), *C. humilus* Bentham (*F, K*), *C. pittieri* Standley (*B*), *C. portoricensis* Bentham (*D*), *C.* spp. (*J*). *A-D, F*, Dehiscent fruits (× 1); *E*, seed in situ (× 1); *G*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 4); *H-I*, seed topography (× 4); *J-K*, testa (× 3, × 50).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Genus: *Pithecellobium* Martius.

Phylogenetic Number: 5.08.

Tribe: Ingeae.

Species Studied - Species in Genus: 8 spp. - ca. 20 spp.

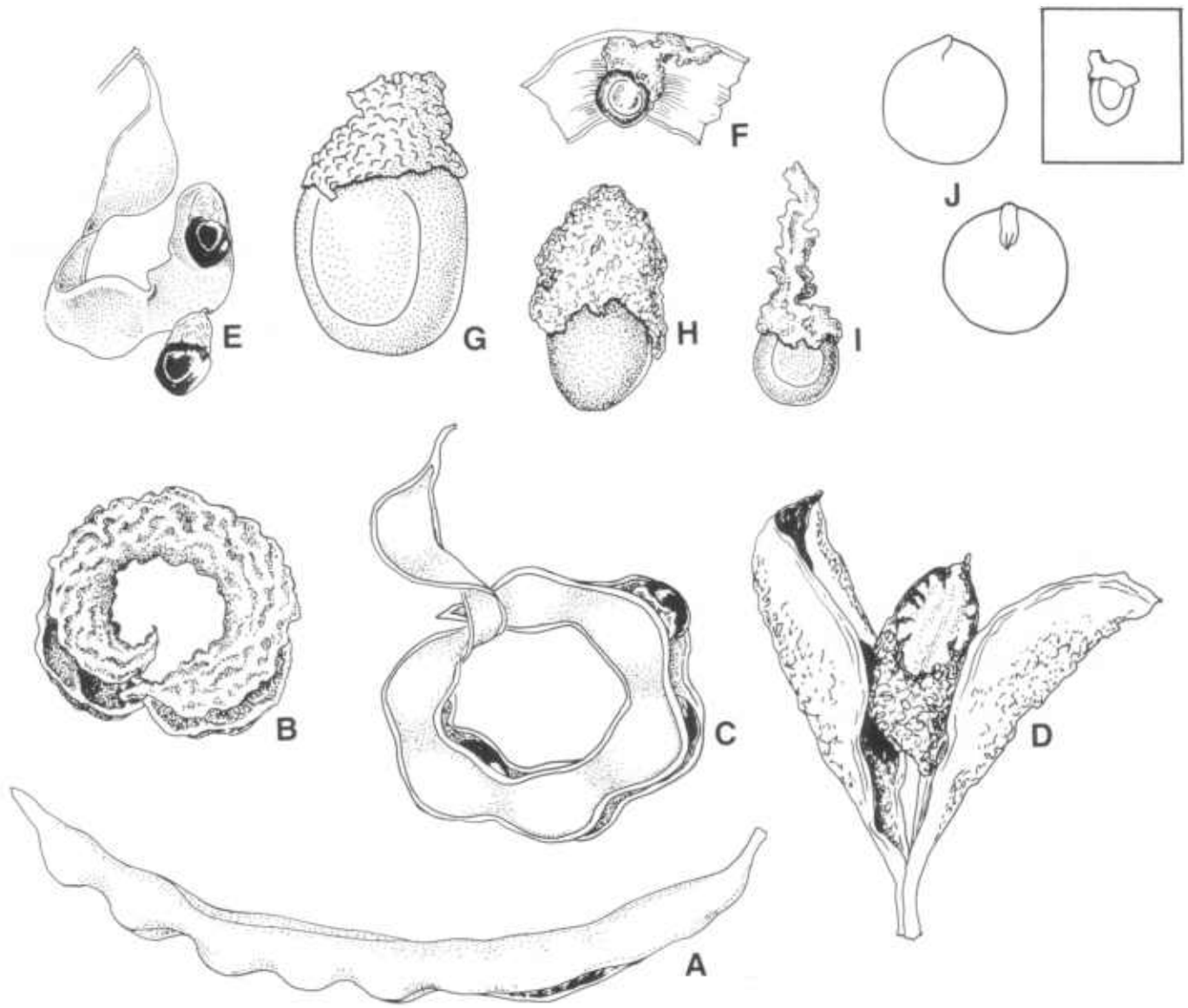
Fruit 5-23 × 0.4-2 × 0.3-2 cm, slightly curved to 1- to several-coiled, without twists, oblong to linear or moniliform, margins not constricted to constricted or ventral margin constricted and dorsal margin slightly constricted, short tapered to rounded or beaked at apex, short tapered to tapered to thick stipe up to 12 mm long or substipitate, terete to compressed, ligneous to subligneous. Valves dehiscing apically either along ventral margin and reflexing or along both margins and not reflexing but perhaps becoming revolute or twisted, remaining attached to sutures, with to without visible seed chambers. Epicarp dull to glossy, dark brown to reddish brown, pubescent to glabrous, rugose to reticulate, not exfoliating. Mesocarp either absent or present and fibrous, ligneous. Endocarp dull, reddish brown to reddish or tan, surface tearing longitudinally during reflexing, nonseptate. Seeds 2-10, longitudinal, overlapping to impinging on shape of adjacent seeds or not overlapping, in 1 series. Funiculus up to 12 mm long, thick (often fringed with arillate tissue), slightly curved to straight. Indurate and expanded funiculi labeled arils, foliaceous and covering up to 2/3 of seed, reddish brown to black or white.

Seed 9-23 × 5.5-10 × 4-10 mm, rectangular to irregular or elliptic to ovate or obovate, compressed to terete. Testa dull, dark brown to black, rugose to shagreen or pitted to smooth, osseous to chartaceous, without or with 75-90 percent pleurogram, with aril (see funiculus), without fracture lines and wing. Hilum punctiform to linear or circular and 5-10 mm long, concealed by aril, recessed to flush, apical to subapical. Lens either not discernible or discernible and 2-5 mm long, linear, depressed, yellowish to tan. Endosperm either absent or present, thin and adnate to testa. Cotyledons with basally groined split over radicle, concealing radicle or all but tip of radicle, occasionally somewhat folded. Embryonic axis straight. Plumule well developed.

Distribution: Central and South America.

Notes: *Pithecellobium* species in the sense of Nielsen (*1981a*) have arillate seeds and usually open pleurograms. Only species wth arillate seeds were included in my study, and some with a chartaceous testa had no pleurogram (*P. lanceolatum*). Seeds of *P. lanceolatum* have a raphe, the point of attachment for the longitudinal aril. Occasionally aril fragments may remain in the fruit, and sometimes the entire aril may be knocked from the seed. Rose (*1899*) provided a note about the sale in Mexico of *P. dulce* seeds for the use of their arils as a human food. Oza (*1971*) studied the seed shapes of *P. dulce.*

Pithecellobium: P. candidum (Kunth) Bentham (*I-J*), *P. dulce* Bentham (*C, H*), *P. guadelupense* Chapman (*F*), *P. lanceolatum* (Humboldt & Bonpland) Bentham (*D*), *P. ligustrinum* Klotzsch ex Bentham (*A*), *P. macrosiphon* Standley (*B*), *P. unguis-cati* (Linnaeus) Bentham (*E, G, L-M*), *P.* spp. (*K*). *A*, Fruit (× 1); *B-C*, dehiscent fruits (× 1); *D-F*, seeds in situ (× 1); *G-I*, seed topography (× 2); *J*, cotyledon concealing radicle (upper) and embryonic axis (lower) (× 3); *K-M*, testa (× 1, × 50, × 1,000).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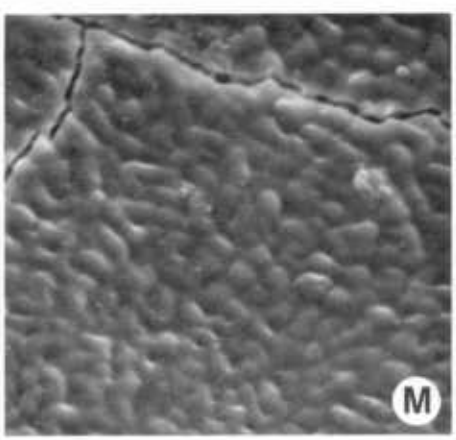
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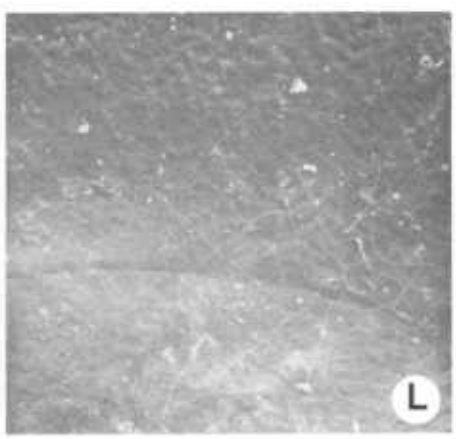
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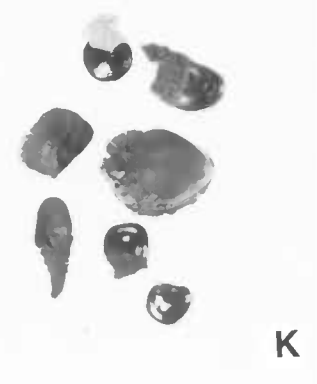
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Genus: *Havardia* Small.

Phylogenetic Number: 5.09.

Tribe: Ingeae.

Species Studied - Species in Genus: 7 spp. - ca. 20 spp.

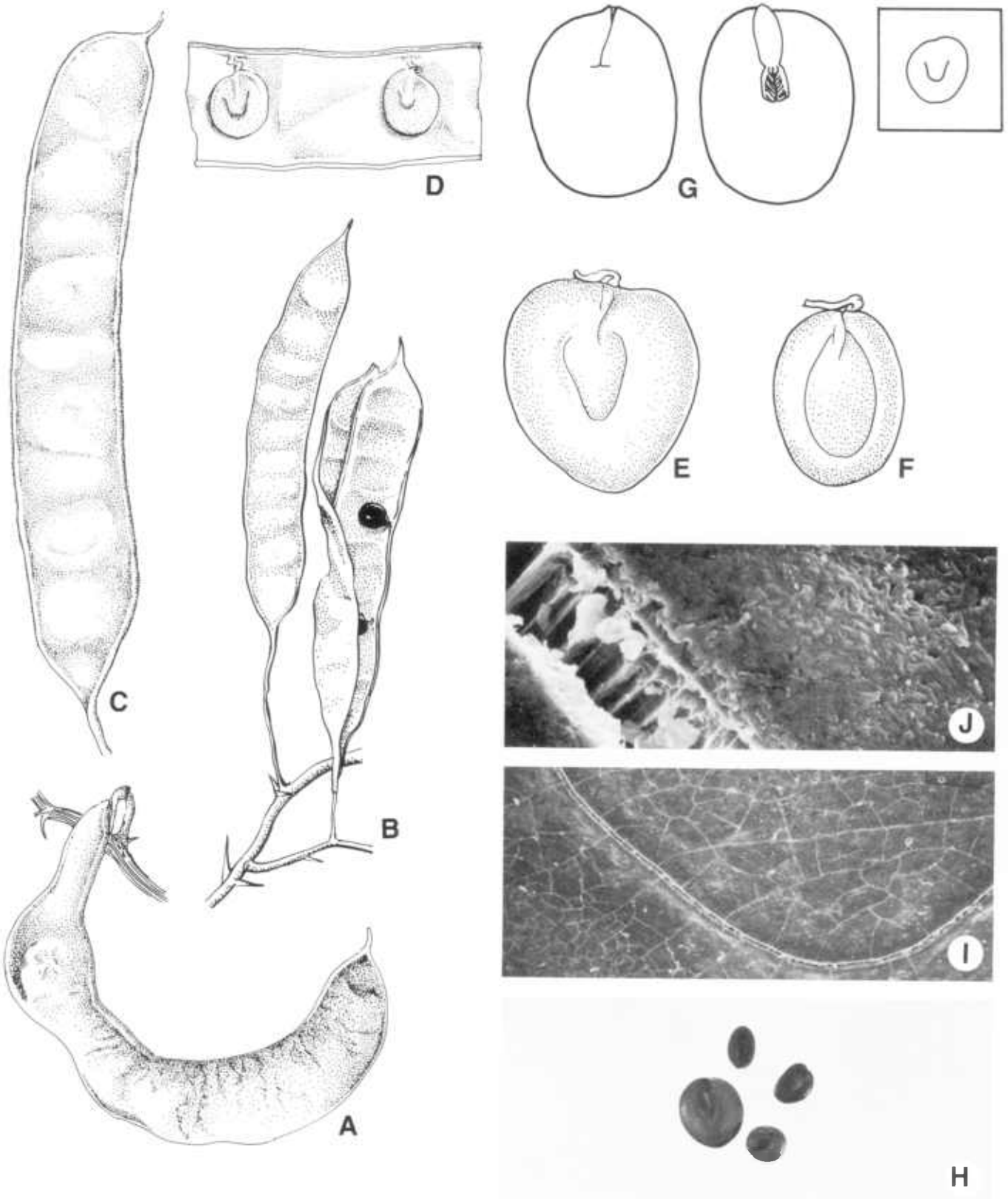
Fruit 4-18 × 1-5 × 0.3-5 cm, straight to 1-coiled, without twists, oblong, margins not constricted, rounded (usually with prominent style) to apex, rounded to short tapered to stipe up to 10 mm long or substipitate, flattened to terete, coriaceous. Valves either dehiscing basally along both margins and separating but not twisting or indehiscent, remaining attached to sutures, with faintly visible seed chambers. Epicarp dull, reddish brown with grayish cast caused by pubescence to blackish brown, pubescent to glandular or glabrous, with parallel transverse venation, not exfoliating. Mesocarp absent. Endocarp dull, ocher and usually darker in seed chamber, nonseptate to subseptate. Seeds 3-15, transverse, not overlapping, in 1 series. Funiculus 4-10 mm long, thick, plicate.

Seed 6-15 × 4.2-12 × 2-5 mm, circular, flattened. Testa glossy, brown to blackish brown, smooth to shagreen or pitted (especially when immature), osseous, with 75-100 percent pleurogram and fracture lines, without wing and aril. Hilum punctiform, concealed by funicular remnant, flush, apical. Lens 0.1-0.5 mm, circular to triangular, mound, brownish yellow to whitish. Endosperm thin, adnate to testa. Cotyledons with basally groined split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed.

Distribution: Subtropical and tropical Central and South America, Ceylon, south India, Thailand, South Vietnam.

Notes: *Havardia* spp. may still be curated with *Pithecellobium*, 5.08. Nielsen (pers. commun., 1982) recommended that *Pithecellobium flexicaule* (Bentham) Coulter be placed here. The fruit is unlike fruits of the studied *Havardia* spp., and I did not include the species in this description and illustration. In a subsequent communication, Nielsen suggested that the species might be referred to the genus *Ebenopsis* Britton & Rose after a revisionary study is completed.

Havardia: H. acatlensis (Bentham) Britton & Rose (*B-D*), *H. leptophylla* (Cavanilles) Britton & Rose (*A, I-J*), *H. pallens* (Bentham) Britton & Rose (*F-G*), *H. sonorae* (S. Watson) Britton & Rose (*E*), *H.* spp. (*H*). *A, C*, Fruits (× 1); *B*, fruit cluster with dehiscent and nondehiscent fruits (× 1); *D*, seeds in situ (× 1); *E-F*, seed topography (× 4); *G*, cotyledon concealing radicle (left) and embryonic axis (right) (× 4); *H-J*, testa (× 1, × 50, × 1,000).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Genus: *Paraserianthes* Nielsen.

Phylogenetic Number: 5.10.

Tribe: Ingeae.

Species Studied - Species in Genus: 1 sp. - 4 spp.

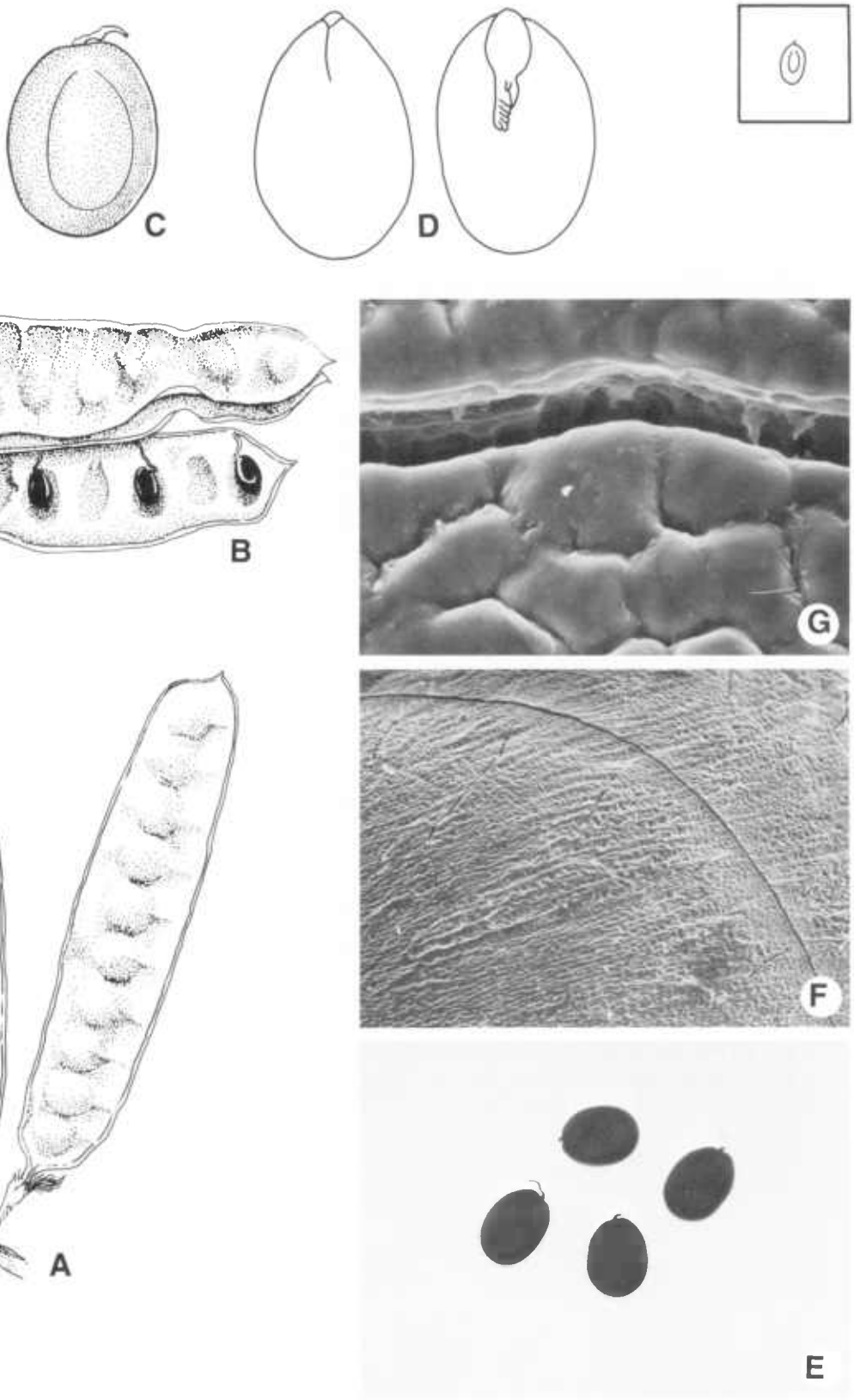
Fruit 7-12.5 × 1.5-2.5 × 0.3-0.4 cm, straight, without twists, oblong to broadly linear, margins not constricted to irregularly once constricted, short tapered to rounded to apex, short tapered to base, substipitate, compressed, coriaceous. Valves either dehiscing apically to tardily dehiscent and splitting along both margins or indehiscent, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown, glabrous to tomentose, with or without well-developed transverse parallel reticulation tending to anastomose near midvalve, not exfoliating. Mesocarp absent. Endocarp dull, buff, septate to nonseptate. Seeds 1-14, transverse, not overlapping, in 1 series. Funiculus up to 8 mm long, thick, hooked to plicate.

Seed 4-13 × 3-9 × 3-4 mm, ovate to elliptic or oblong, compressed. Testa glossy, black, minutely pitted, osseous, with 90 percent pleurogram and fracture lines, without wing and aril. Hilum punctiform, concealed by funicular remnant, flush, apical. Lens 0.3-0.4 mm long, elliptic to circular, mound, black. Endosperm thick, adnate to testa. Cotyledons with simple split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule well developed.

Distribution: Sumatra to New Guinea, Solomon Islands, Australia.

Notes: Dell (*1980*) demonstrated that entry of water into heated hard seeds of *P. lophantha* (*Albizia lophantha* (Willdenow) Bentham of Dell) is controlled by eruption of a small (0.3 × 0.25 mm) strophiolar plug adjacent to the hilum. This plug is the lens. Nielsen et al. (*1983*) is the source of the number of species in the genus, not Nielsen (*1981a*).

Paraserianthes: P. lophantha (Bentham) Nielsen subsp. *lophantha* (*A, C-D, F-G*), *P. lophantha* (Bentham) Nielsen subsp. *montana* (Junghuhn) Nielsen (*B*), *P. lophantha* (Bentham) Nielsen (*E*). *A*, Fruit cluster (× 1); *B*, fruit cluster with seeds in situ (× 1); *C*, seed topography (× 4); *D*, cotyledon concealing all but radicle tip (left) and embryonic axis (right) (× 4); *E-G*, testa (× 1, × 50, × 1,000).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Genus: *Serianthes* Bentham.

Phylogenetic Number: 5.11.

Tribe: Ingeae.

Species Studied - Species in Genus: 8 spp. - ca. 20 spp.

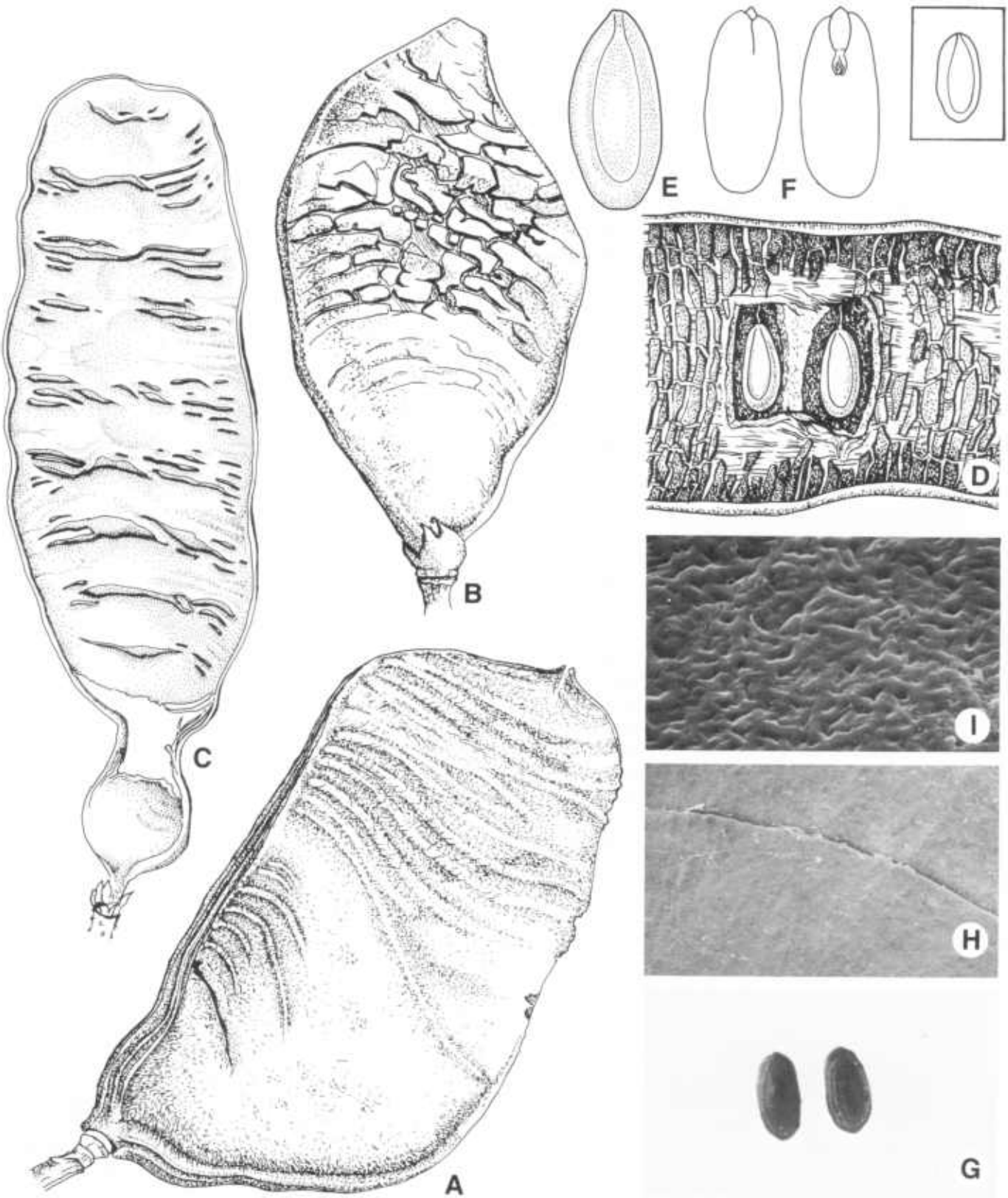
Fruit 7-35 × 2.5-8 × 0.7-2.7 cm, straight to curved or nearly coiled, without twists, ovate to oblong or linear (occasionally with 1-2 mature seeds near apex), margins not constricted to constricted, short tapered to rounded apex, short tapered to rounded to base, nonstipitate to substipitate (not exceeding 5 mm), compressed, ligneous. Valves indehiscent to sometimes tardily dehiscent, remaining attached to sutures, with or without visible seed chambers. Epicarp dull, brown to purple brown or blackish brown, glabrous to velutinous eroding with age revealing shagreen surface, oblique parallel veins anastomosing near center of valve to reticulate or veins not discernible, checking and exfoliating. Mesocarp fibrous, ligneous. Endocarp dull, brown, septate. Seeds 1-6, transverse, not overlapping, in 1 series. Funiculus up to 18 mm long, filiform, curved.

Seed 12-20 × 7-11 × 1-5 mm, elliptic to ovate, compressed to flattened. Testa glossy to dull, brown to dark reddish brown, smooth, coriaceous to osseous, with 90-100 percent pleurogram, with or without fracture lines, without wing and aril. Hilum punctiform, exposed to concealed by funicular remnant, flush, subapical. Lens 0.2 mm long, elliptic, flush to mound, tan and either within black partial halo or halo absent. Endosperm absent. Cotyledons with simple split over radicle, concealing all but tip of radicle. Embryonic axis straight. Plumule well developed.

Distribution: Malay Peninsula and Archipelago, New Caledonia, Oceania.

Notes: The number of species in this genus came from Nielsen (pers. commun., 1982) and not Nielsen (*1981a*). Kanis (*1979*) has monographed the Malayan species, and Nielsen et al. (*1983*) named a new species.

Serianthes: S. dilmyi Fosberg (*B*), *S. hooglandii* (Fosberg) Kanis (*D-F*), *S. minahassae* (Koorders) Merrill & Perry subsp. *ledermannii* (Harms) Kanis (*C*), *S. myriadenia* (Guillemin) Planchon ex Bentham (*A*), *S. vitiensis* A. Gray (*G–I*). *A-C*, Fruits (× 1); *D*, seeds in situ (× 1); *E*, seed topography (× 2); *F*, cotyledons concealing all but radicle tip (left) and embryonic axis (right) (× 2); *G–I*, testa (× 1, × 50, × 1,000).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Genus: *Wallaceodendron* Koorders.

Phylogenetic Number: 5.12.

Tribe: Ingeae.

Species Studied - Species in Genus: 1 sp. - 1 sp.

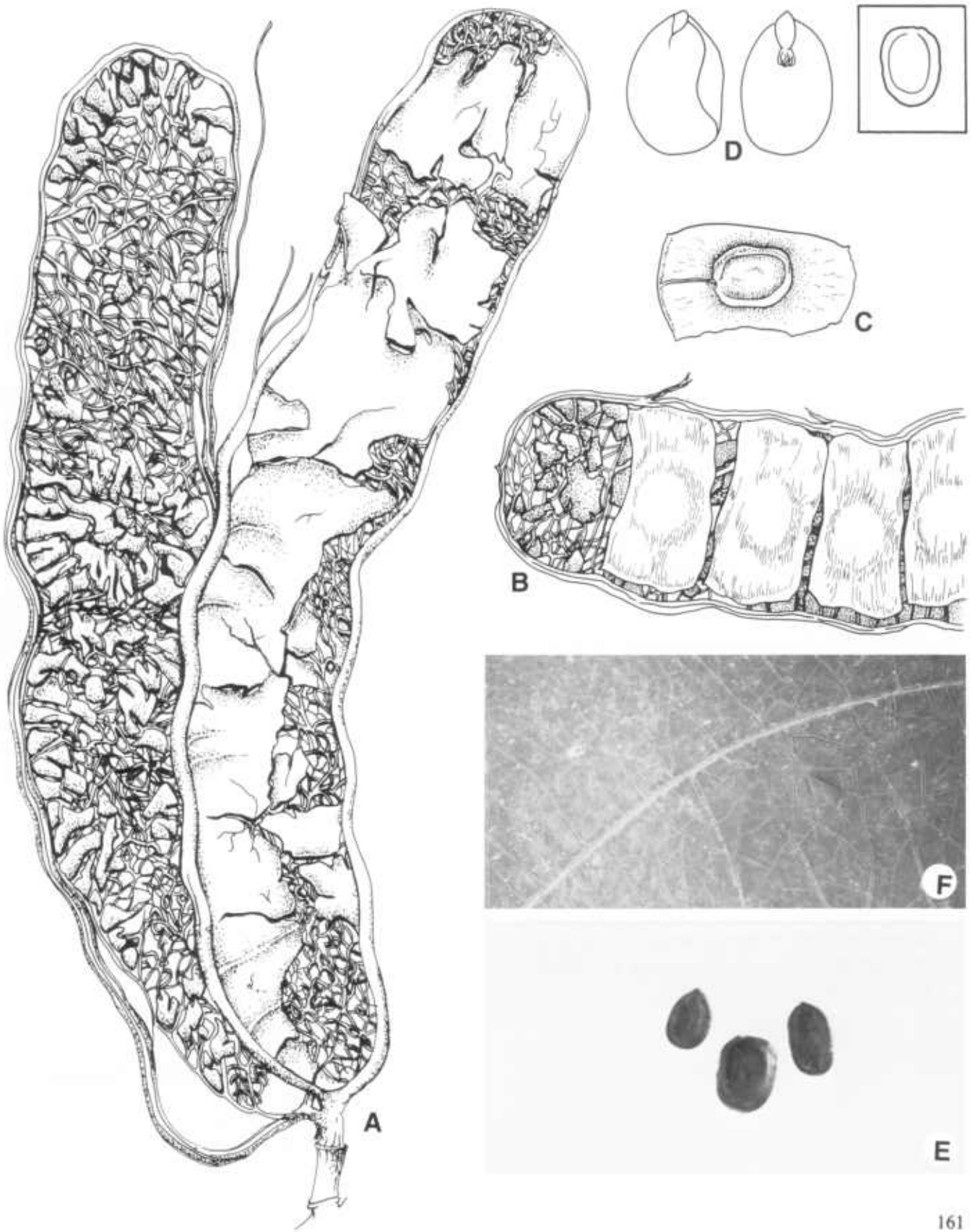
Fruit 10-20 × 2.5-4 × 0.8-2.5 cm, straight to curved, without twists, oblong, margins constricted to not constricted, rounded to short tapered to apex, short tapered to base, substipitate (3-5 mm long), compressed, ligneous. Valves dehiscing apically but barely separating and with endocarp eventually falling from sutures as 1-seeded winged segments and leaving fibrous part of mesocarp attached to sutures, with or without seed chambers. Epicarp dull, when young covered with reddish-brown pubescence and when mature glabrate and surface dark brown, shagreen, checking and exfoliating. Mesocarp fibrous, ligneous, mealy between and separating from fibers. Endocarp dull, wings ocher and seed chambers reddish brown, septate. Seeds 3-11, transverse, not overlapping, in 1 series. Funiculus up to 35 mm long, filiform, coiled.

Seed 13-15 × 10-13 × 2-4 mm, oblong, compressed. Testa glossy, brown, smooth, coriaceous, with 90 percent pleurogram, with or without fracture lines, without wing and aril. Hilum punctiform, exposed, recessed, subapical. Lens 0.2 mm long, elliptic to linear, mound in depression, yellowish between black lines. Endosperm absent. Cotyledons with simple split over radicle, concealing all but tip of radicle, folded one over other along 1 side. Embryonic axis straight. Plumule well developed.

Distribution: Philippine Islands and Celebes.

Notes: *Wallaceodendron celebicum* "dehisces" one-seeded, winged, indehiscent endocarp segments similar to *Plathymenia* spp. in the Mimoseae.

Wallaceodendron: W. celebicum Koorders (*A-F*). *A*, Dehiscent mesocarp with epicarp fragments (× 1); *B*, partial mesocarp with 1-seeded endocarp segments (× 1); *C*, seed in situ (× 1); *D*, folded cotyledon concealing all but tip of radicle (left) and embryonic axis (right) (× 2); *E-F*, testa (× 1, × 50).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Genus: *Archidendropsis* Nielsen.

Phylogenetic Number: 5.13.

Tribe: Ingeae.

Species Studied - Species in Genus: 3 spp. - ca. 15 spp.

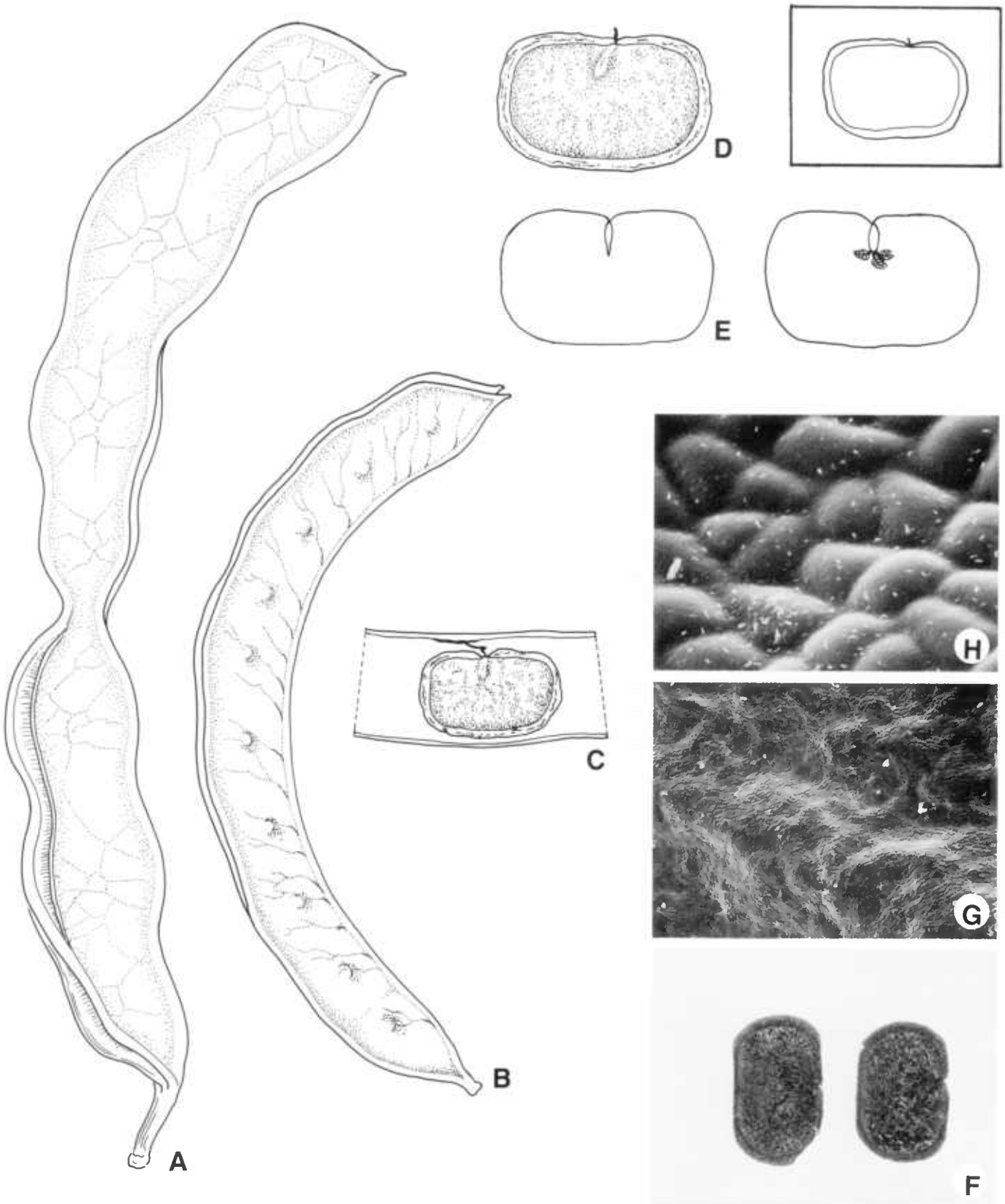
Fruit 4.2-18 × 0.5-3 × 0.5-2.5 cm, straight to curved, without twists, linear to oblong, margins constricted to slightly constricted, short tapered to rounded to apex, short tapered to base, substipitate, flattened to compressed, chartaceous to subligneous. Valves dehiscing apically along both margins and scissoring apart, remaining attached to sutures, with to without visible seed chambers. Epicarp dull to glossy, yellowish brown to dark brown, pubescent to glabrate or glabrous, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, tan to brown, nonseptate. Seeds 11-13, parallel, not overlapping, in 1 series. Funiculus 4-5 mm long, filiform, curved to plicate.

Seed 5-28 × 5.5-17 × 0.5-1 mm, oblong, flattened. Testa glossy, dark brown, rugose, chartaceous, with winglike rim (up to 2 mm wide), without pleurogram or fracture line or aril. Hilum punctiform, concealed by funicular remnant, flush but in notch, apical according to embryonic axis and marginal according to seed length. Lens not discernible. Endosperm absent. Cotyledons notched exposing radicle. Embryonic axis straight. Plumule well developed.

Distribution: New Guinea, Solomon Islands to New Caledonia.

Notes: The seed of *A. streptocarpa* is similar in structure to the seed of *Anadenanthera colubriana* (Vellozo) Brenan. Nielsen et al. (*1983*) monographed the genus and is the source of the number of species in the genus, not Nielsen (*1981a*). Fruits of *A. basaltica* (F. v. Mueller) Nielsen are glandular (Nielsen et al., *1983*).

Archidendropsis: A. macradenia (Harms) Nielsen (*B*), *A. oblongum* (Hemsley) Nielsen (*A*), *A. streptocarpa* (Fournier) Nielsen (*C-H*). *A-B*, Dehiscent fruits (× 1); *C*, seed in situ (× 1); *D*, seed topography (× 1.5); *E*, cotyledon not concealing radicle (left) and embryonic axis (right) (× 1.5); *F-H*, testa (× 1, × 50, × 1,000).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Genus: *Pararchidendron* Nielsen.

Phylogenetic Number: 5.14.

Tribe: Ingeae.

Species Studied - Species in Genus: 1 sp. - 1 sp.

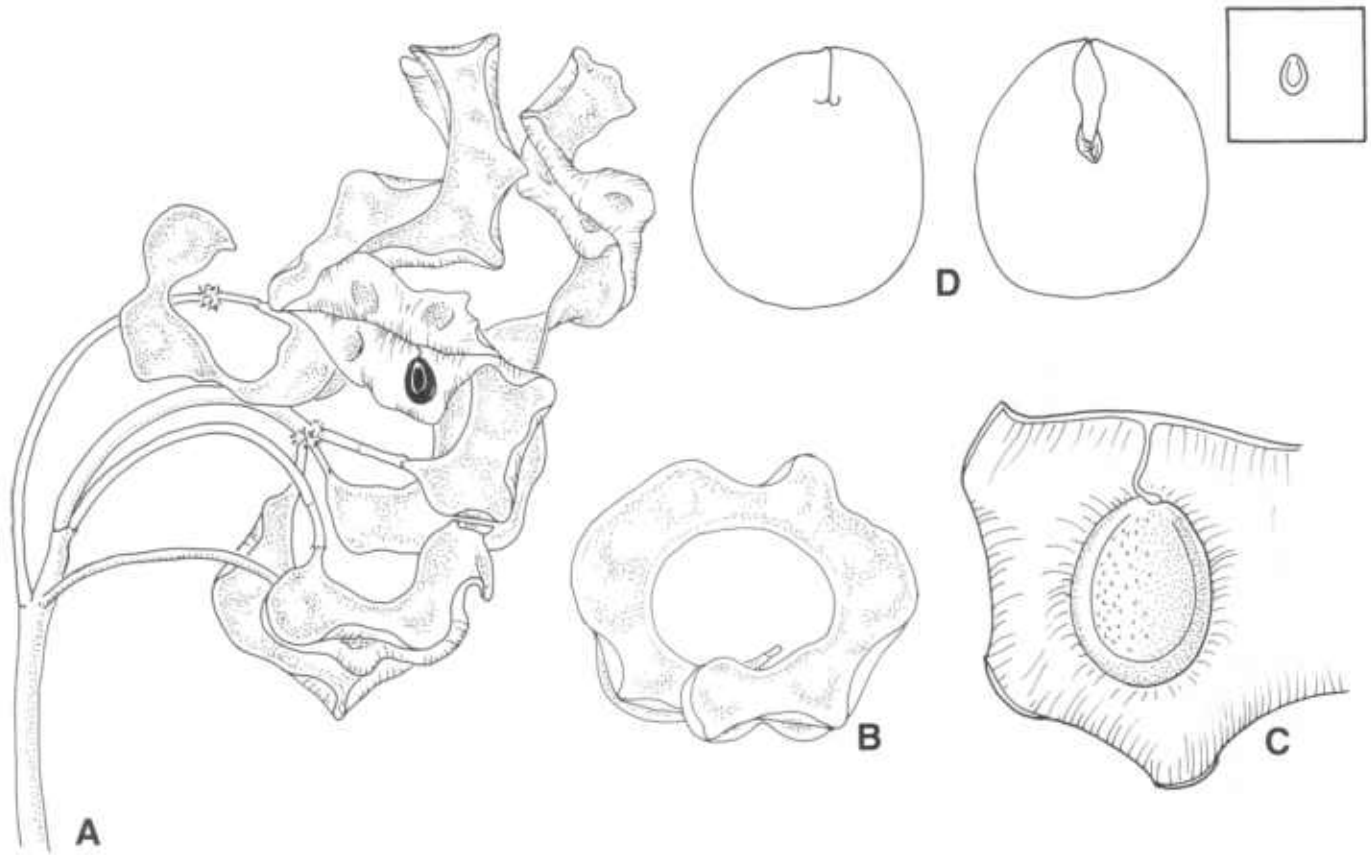
Fruit 10-12 × 1-2 × 0.5-1 cm, ½- to 1-coiled, without twists, oblong, constricted along dorsal margin and less constricted along ventral margin, rounded to tapered to apex, short tapered to base, substipitate to nonstipitate, flattened, coriaceous. Valves dehiscing medially and recurving along dorsal margin, remaining attached to sutures, with visible seed chambers. Epicarp dull, reddish black to brown or yellowish, densely pubescent, not exfoliating. Mesocarp absent. Endocarp dull, orange to red, nonseptate. Seeds 2-9, transverse, not overlapping, in 1 series. Funiculus 2.3 mm long, thick, straight to curved or hooked near seed.

Seed 6-7 × 4.5-5 × 2-3 mm, elliptic, compressed. Testa glossy, black, shallowly pitted in areola, osseous, with 90 percent pleurogram and fracture lines, without wing and aril. Hilum punctiform, concealed by funicular remnant, flush, subapical (almost apical). Lens not discernible. Endosperm absent. Cotyledons with basally groined split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed.

Distribution: Java, Lesser Sunda Islands, New Guinea, Australia (Queensland and northern New South Wales).

Notes: More seeds and fruits should be collected and distributed to herbaria. Verdcourt (*1979*) described seeds of *Abarema sapindoides* (A. Cunningham ex Sweet) Kostermans as arillate and regarded *P. pruinosum* as a synonym of *A. sapindoides*. The several seeds I studied were not arillate. The number of species in this genus and their distribution came from Nielsen et al. (*1983*), not Nielsen (*1981a*).

Pararchidendron: P. pruinosum (A. Cunningham ex Bentham) Nielsen (*A-G*). *A,* Fruit cluster with dehiscent and nondehiscent fruits (× 1); *B,* dehiscent fruit (× 1); *C,* seed in situ (× 5); *D,* cotyledon concealing radicle (left) and embryonic axis (right) (× 5); *E-G,* testa (× 3, × 50, × 1,000).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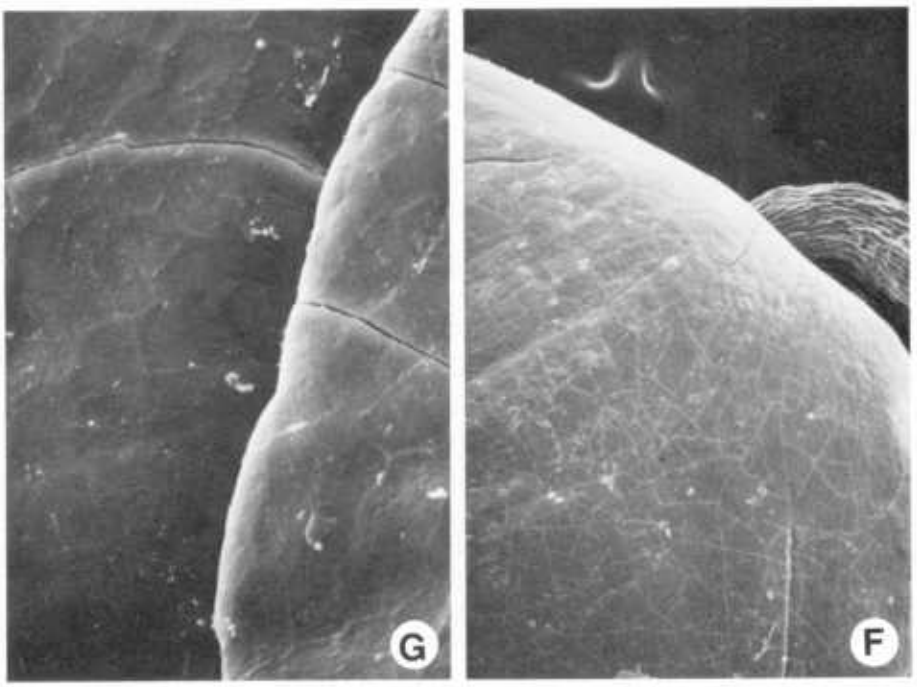
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E

Genus: *Archidendron* F. v. Mueller s.l.

Phylogenetic Number: 5.15.

Tribe: Ingeae.

Species Studied - Species in Genus: 13 spp. - ca. 100 spp.

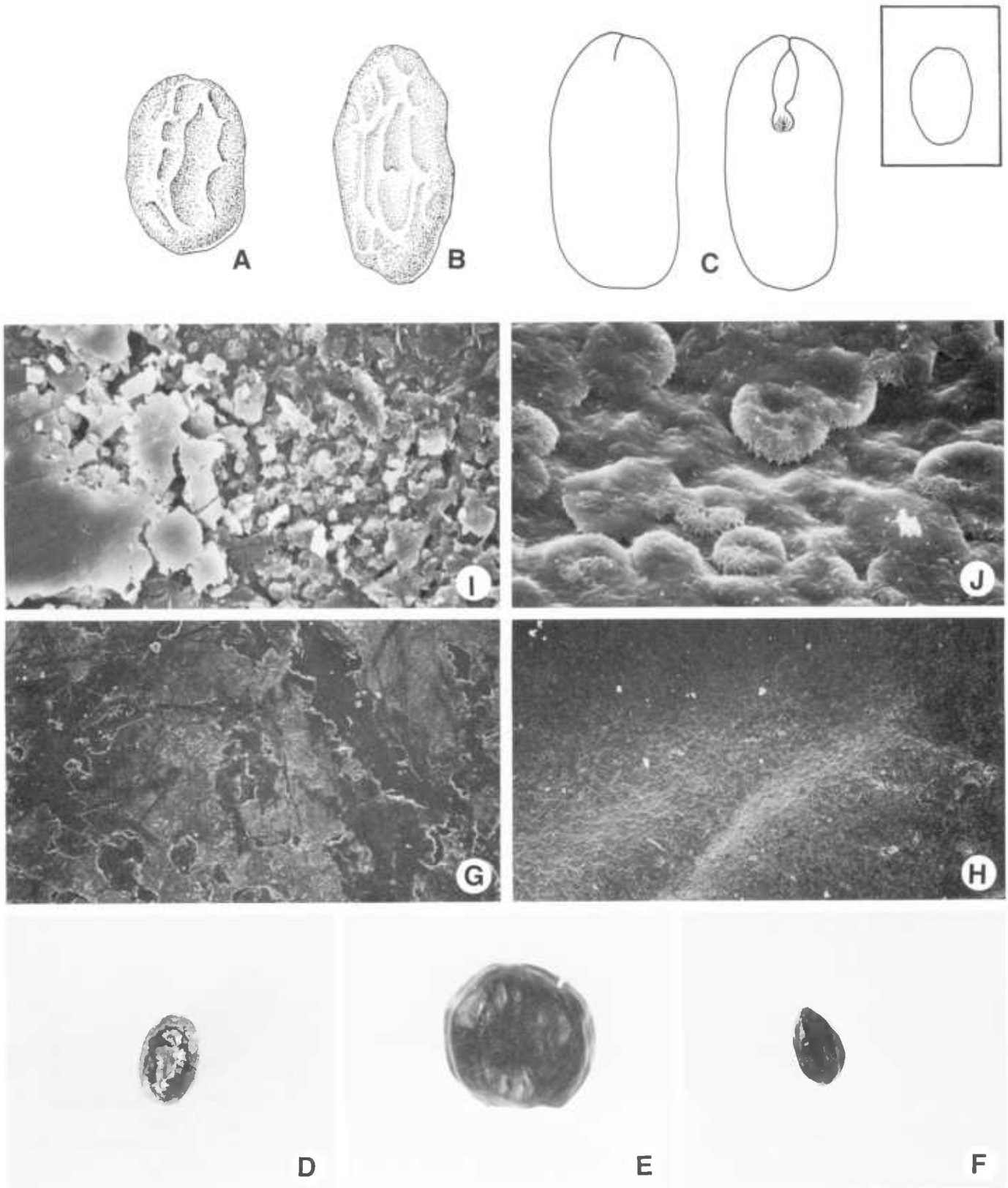
Fruit 3-50 × 1-8.5 × 0.4-4 cm, straight to spirally coiled, with or without twists, linear to oblong or moniliform, margins not constricted to constricted, rounded to apex, tapered to stipe up to 40 mm long or substipitate, flattened to terete, fleshy when fresh and drying coriaceous to ligneous. Valves tardily dehiscing medially along dorsal or occasionally ventral margin and twisting, remaining attached to sutures, with or without visible seed chambers. Epicarp dull, brown (various shades) to red or greenish, glabrous to pubescent, smooth to rugose or reticulate, not exfoliating. Mesocarp absent or present and fibrous, ligneous. Endocarp dull to glossy, orange to red or brown to gray or white, rugose, subseptate to nonseptate. Seeds 2-15, transverse, not overlapping, in 1 series. Funiculus 1-15 mm long, thick to filiform, straight to hooked or plicate.

Seed 8-45 × 7-23 × 4-30 mm, circular to elliptic or oblong to reniform, terete to compressed. Testa glossy, bluish black to yellowish or brownish (occasionally with bloom), rugose to smooth, with or without 1 sulcus on each face, chartaceous to osseous, without pleurogram or fracture line or wing or aril. Hilum punctiform to circular or elliptic and up to 5 mm in diameter, concealed by orange-brown to reddish-brown funicular remnant, flush to raised, apical. Lens not discernible. Endosperm absent. Cotyledons with simple split over radicle, concealing radicle, rugose to smooth. Embryonic axis straight. Plumule well developed.

Distribution: Ceylon to northern Australia (Queensland and northern New South Wales).

Notes: The species from mainland southeast Asia were monographed by Nielsen (*1979a*).

Archidendron seeds: *A. aruense* (Warburg) de Wit (*C*), *A. ellipticum* (Blume) Nielsen (*A, D, G, I*), *A. jiringa* (Jack) Nielsen (*E*), *A. lucyi* F. v. Mueller (*B, F, H, J*). *A-B*, Seed topography (× 2); *C*, cotyledons concealing radicle (left) and embryonic axis (right) (× 3); *D-J*, testa (× 1, × 1, × 1, × 50, × 50, × 1,000, × 1,000).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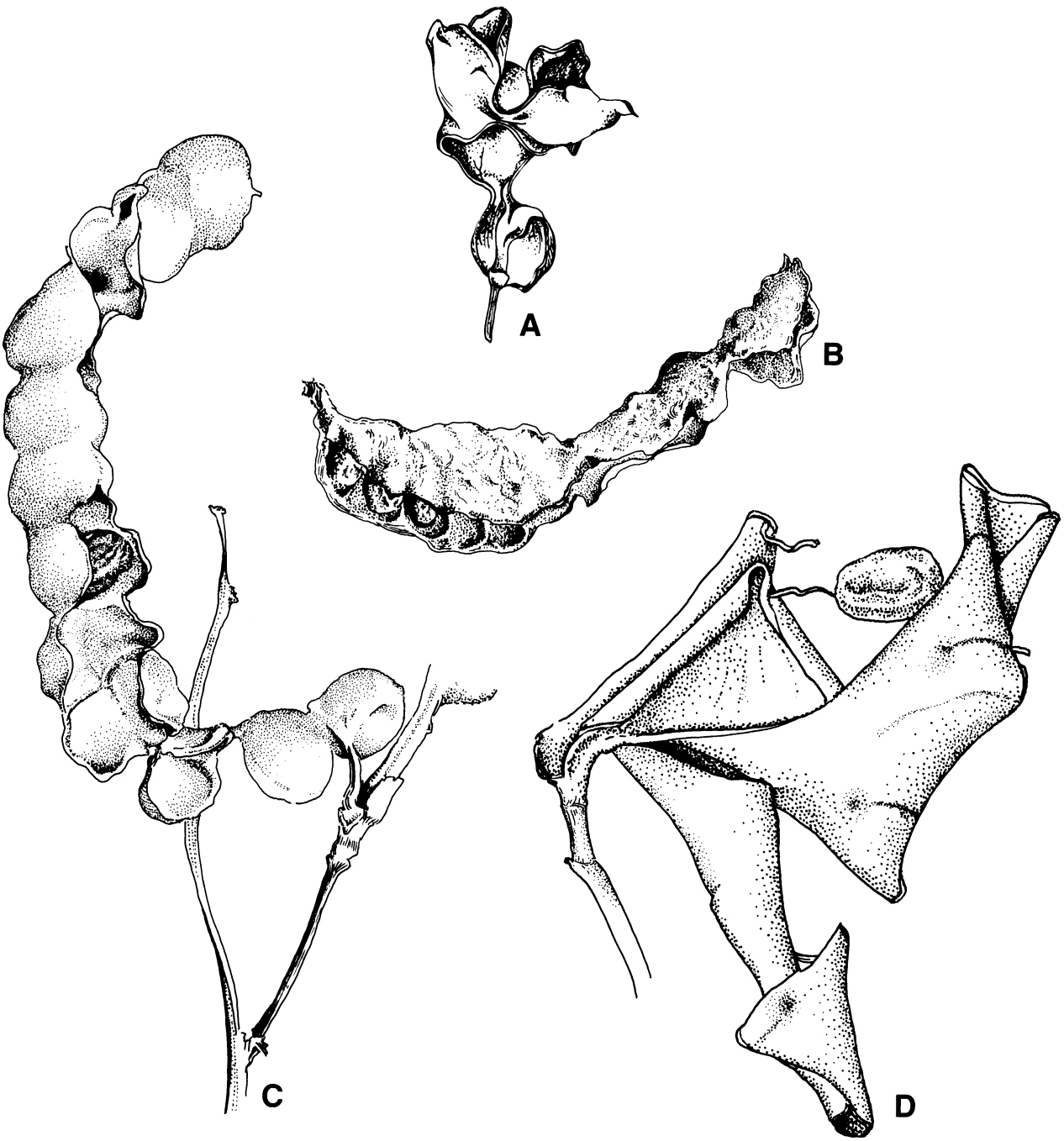
Archidendron fruits: *A. ellipticum* (Blume) Nielsen (*D*), *A. glabrum* (K. Schumann) Lauterbach & K. Schumann (*A*), *A. hispidum* (Mohlenbrock) Verdcourt (*B*), *A. lucyi* F. v. Mueller (*C*). *A-D*, Dehiscent fruits (× 1).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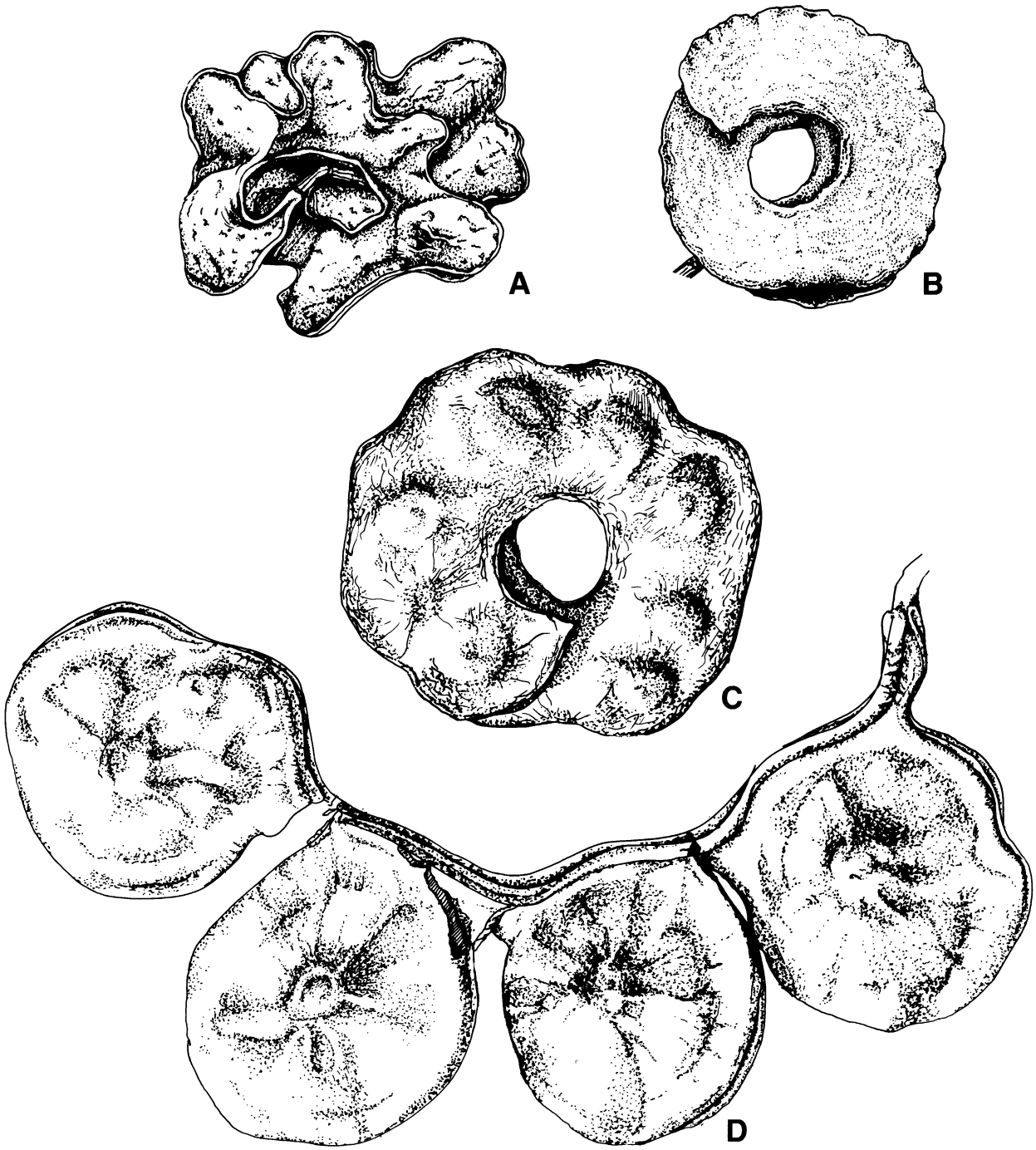
Archidendron fruits (con.): *A. fagifolium* (Blume ex Miquel) Nielsen (*C*), *A. grandiflorum* (Solander ex Bentham) Nielsen (*B*), *A. incurvatum* Lauterbach & K. Schumann (*A*), *A. jiringa* (Jack) Nielsen (*D*). *A-D*, Fruits (× 1).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Genus: *Zygia* Boehmer.

Phylogenetic Number: 5.16.

Tribe: Ingeae.

Species Studied - Species in Genus: 5 spp. - ca. 20 spp.

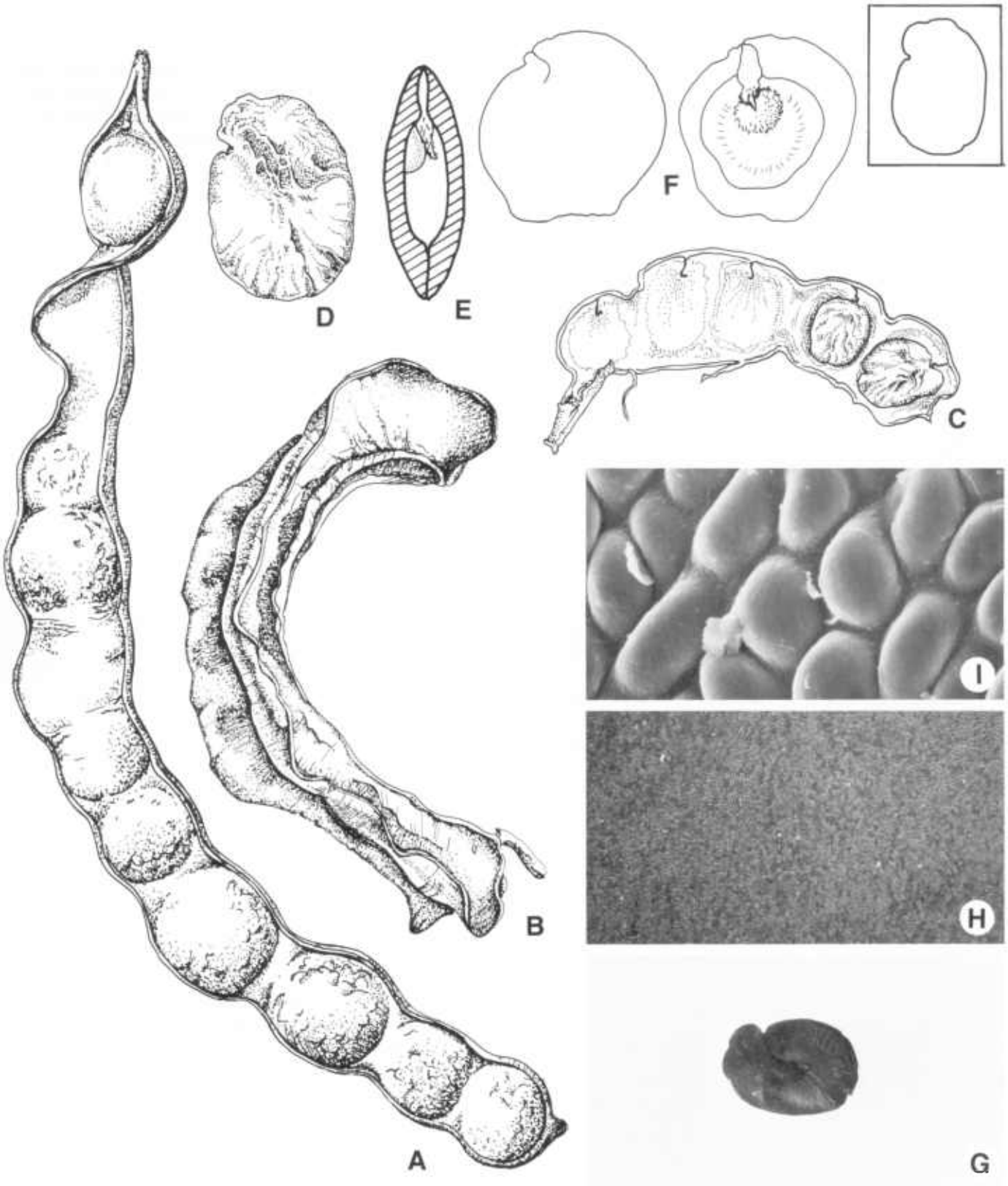
Fruit 5-30 × 1.2-2.5 × 1 cm, straight or curved, without twists, oblong, margins not constricted to constricted, rounded to apex, rounded to tapered to base, nonstipitate to substipitate, flattened to compressed, ligneous. Valves tardily dehiscing apically and reflexing along ventral margin, remaining attached to sutures, with faintly visible seed chamber. Epicarp dull, brown, minutely pubescent to glabrate or glabrous, shagreen, not exfoliating. Mesocarp mealy and fibrous, ligneous. Endocarp dull, reddish brown, nonseptate. Seeds 2-12, transverse, not overlapping, in 1 series. Funiculus 3-4 mm long, thick, curved.

Seed 15-25 × 13-20 × 5-7 mm, irregular to circular or oblong, compressed to flattened. Testa dull, brown, rugose and shagreen, coriaceous, without pleurogram or fracture lines or wing or aril. Hilum punctiform, exposed, recessed, subapical to apical. Lens 2 mm long, elliptic, pit, color of testa. Endosperm absent. Cotyledons with simple split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed and densely pubescent.

Distribution: Central America and tropical South America.

Notes: At least *Z. latifolia* has concaved cotyledon faces (*E*) similar to the faces found in *Entada gigas*, 3.13.

Zygia: Z. inaequalis (Kunth) Pittier (*B*), *Z. latifolia* (Linnaeus) Fawcett & Rendle (*C-I*), *Z. pilosula* (Pittier) Britton & Rose (*A*). *A*, Fruit (× 1); *B*, dehiscent fruit (× 1); *C*, seeds in situ (× 1); *D*, seed topography (× 1.5); *E*, seed in transection showing empty space between cotyledons (× 1.5); *F*, folded cotyledon concealing radicle (left) and embryonic axis (right) (× 2); *G-I*, testa (× 1, × 50, × 1,000).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Genus: *Cojoba* Britton & Rose.

Phylogenetic Number: 5.17.

Tribe: Ingeae.

Species Studied - Species in Genus: 6 spp. - ca. 20 spp.

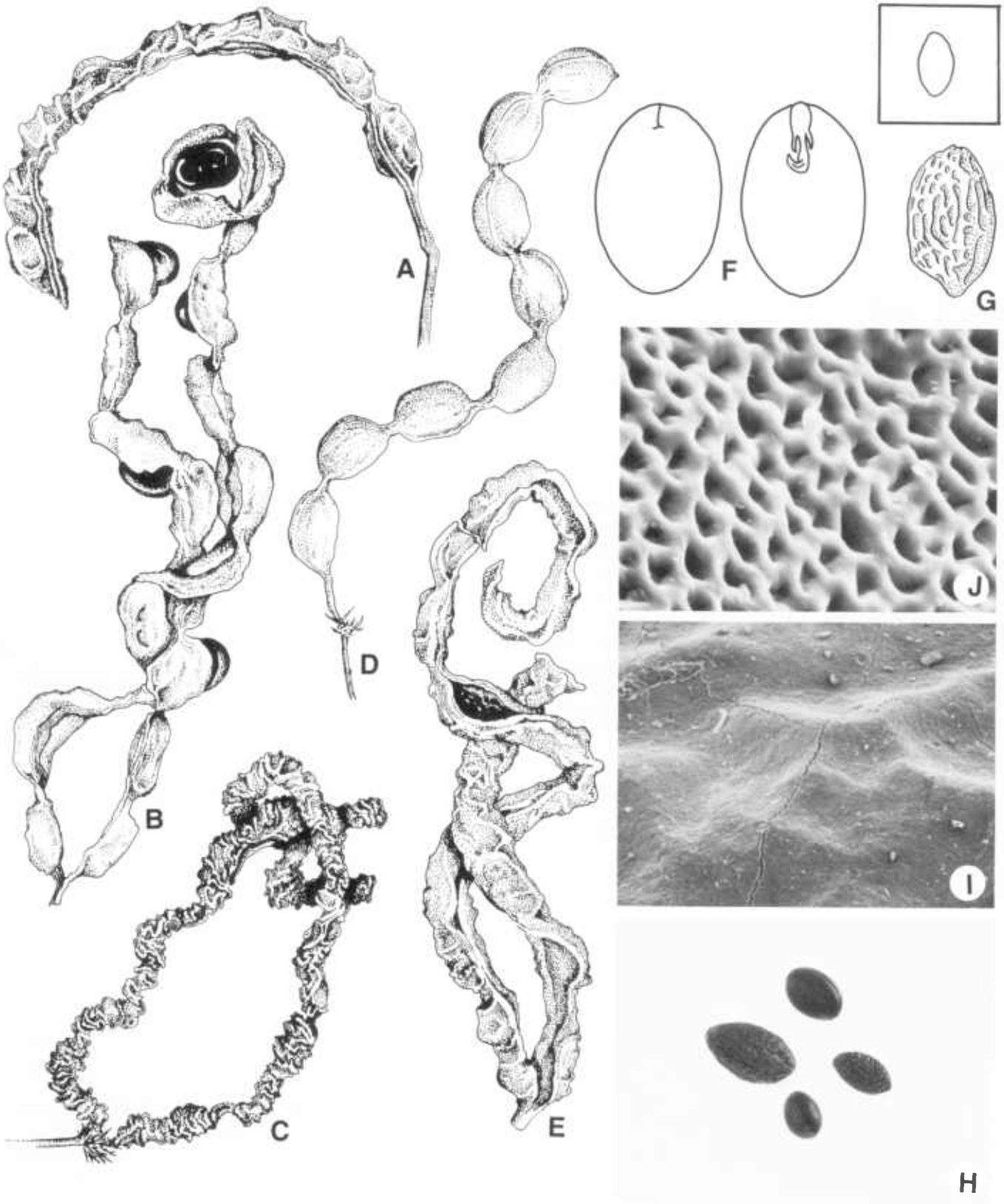
Fruit 2-22 × 0.6-1 × 0.6-1.1 cm, ½- to 1-coiled, with or without twists, moniliform, margins constricted, rounded to short tapered to apex, short tapered to stipe 10 mm long, terete, coriaceous. Valves dehiscing medially along ventral margin and twisting, remaining attached to sutures, with visible seed chambers. Epicarp dull, grayish to reddish brown, puberulent to glabrous, with or without prominent wrinkles, becoming mealy and if exfoliating revealing blackish to reddish smooth to reticulate surface, not exfoliating to exfoliating. Mesocarp absent. Endocarp glossy, dark brown to tan or red, smooth to fibrous, septate. Seeds 8-12, parallel, not overlapping, in 1 series. Funiculus 1.5 mm long, thick, straight.

Seed 7.7-20 × 5.5-12 × 5.5-12 mm, oblong to circular, terete or nearly so. Testa glossy, black to bluish black, pitted and rugose, with or without raphe length of seed, coriaceous, without pleurogram or fracture lines or wing or aril. Hilum irregular to circular, concealed by funicular remnant or exposed, recessed or nearly so, subapical. Lens not discernible. Endosperm absent. Cotyledons with groined split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed.

Distribution: Central and South America.

Notes: The fruits of *Cojoba* spp. change in shape, size, and surface topography before and after dehiscence. When seeds are present, the fruits are moniliform and turgid (*D*), and when seeds have dehisced, the fruits lose their shape and turgidity (*C*).

Cojoba: C. arborea (Linnaeus) Britton & Rose (*A, E, I-J*), *C. donnell-smithii* Britton & Rose (*B, D, G*), *C. rubescens* (Bentham) Britton & Rose (*C, F*), *C.* spp. (*H*). *A, D,* Fruits with several seeds (× 1); *B, E,* dehiscent fruits with at least 1 seed (× 1); *C,* dehiscent fruit cluster without seeds (× 1); *F,* cotyledons concealing radicle (left) and embryonic axis (right) (× 3); *G,* seed topography (× 2); *H-J,* testa (× 1, × 50, × 1,000).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Genus: *Cedrelinga* Ducke.

Phylogenetic Number: 5.18.

Tribe: Ingeae.

Species Studied - Species in Genus: 1 sp. - 1 sp.

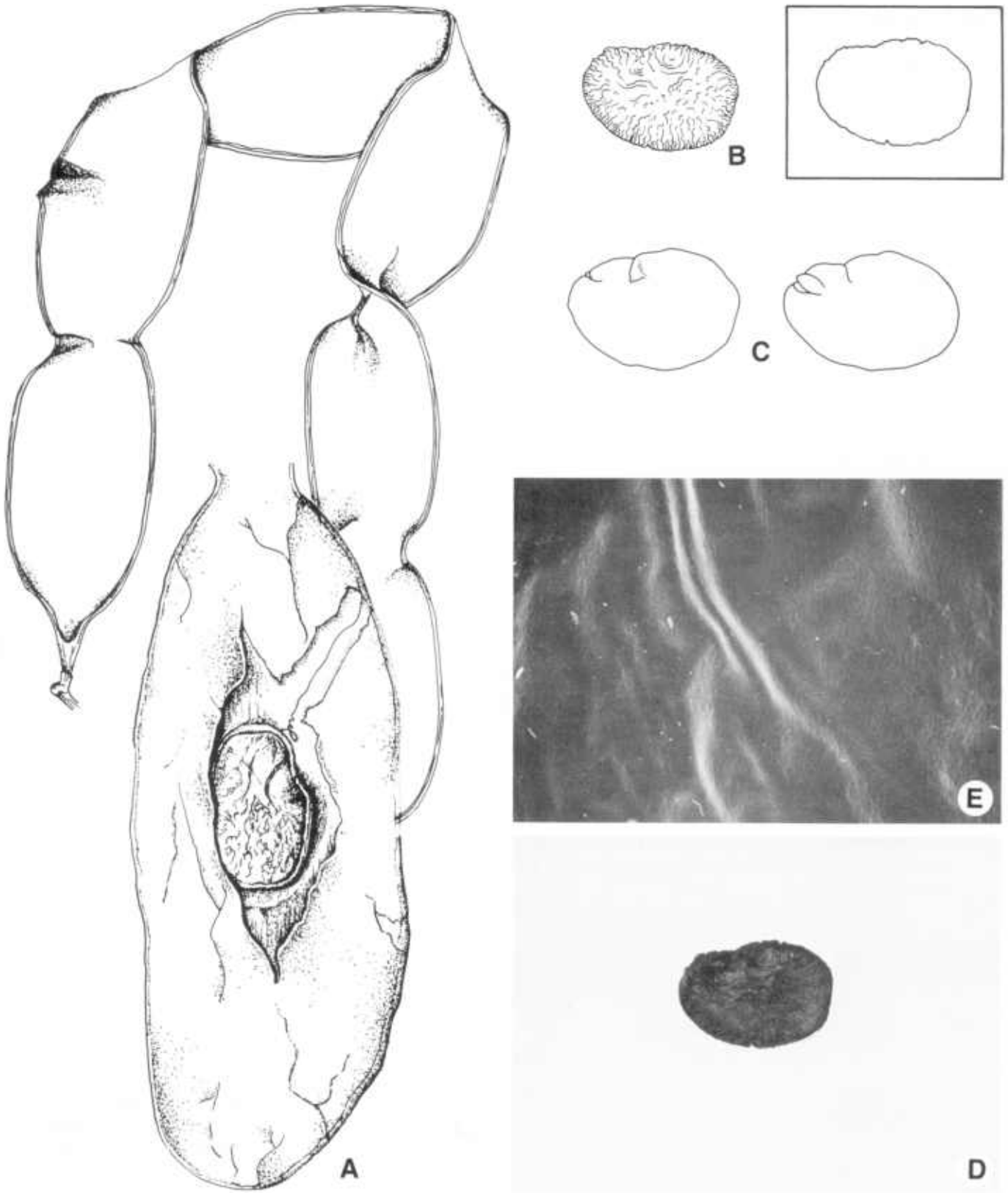
Fruit 50-60 × 3-5.5 × 0.1-0.3 cm, straight, with or without twists at joints, broadly linear, margins constricted, rounded to apex, short tapered to stipe up to 25 mm long, flattened, coriaceous. Valves indehiscent, remaining attached to sutures, with visible seed chambers. Epicarp dull, brown, glabrous, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, brown, septate around seed (not transversely septate). Seeds up to 6, parallel, not overlapping, in 1 series. Funiculus up to 30 mm long, filiform, plicate.

Seed 25-36 × 15-18 × 1-2 mm, subcircular, flattened. Testa glossy, brown, rugose, chartaceous, without pleurogram or fracture lines or wing or aril. Hilum punctiform, exposed, flush, subapical according to embryonic axis and nearly marginal according to seed length. Lens 0.1 mm long, linear, mound, black. Endosperm absent. Cotyledons with either simple split over radicle and either concealing all but tip of radicle or notched and exposing entire radicle. Embryonic axis slightly deflexed to straight. Plumule rudimentary.

Distribution: Brazil.

Notes: The fruit and seed are unusual in the subfamily.

Cedrelinga: C. catenaeformis Ducke (*A-E*). *A*, Seed in situ (foreground × 1) and fruit (background × 0.5); *B*, seed topography (× 1); *C*, cotyledons concealing all but radicle tip (left) and embryonic axis (right) (× 1); *D-E*, testa (× 1, × 50).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Genus: *Klugiodendron* Britton & Killip.

Phylogenetic Number: 5.19.

Tribe: Ingeae.

Species Studied - Species in Genus: 1 sp. - number not determined.

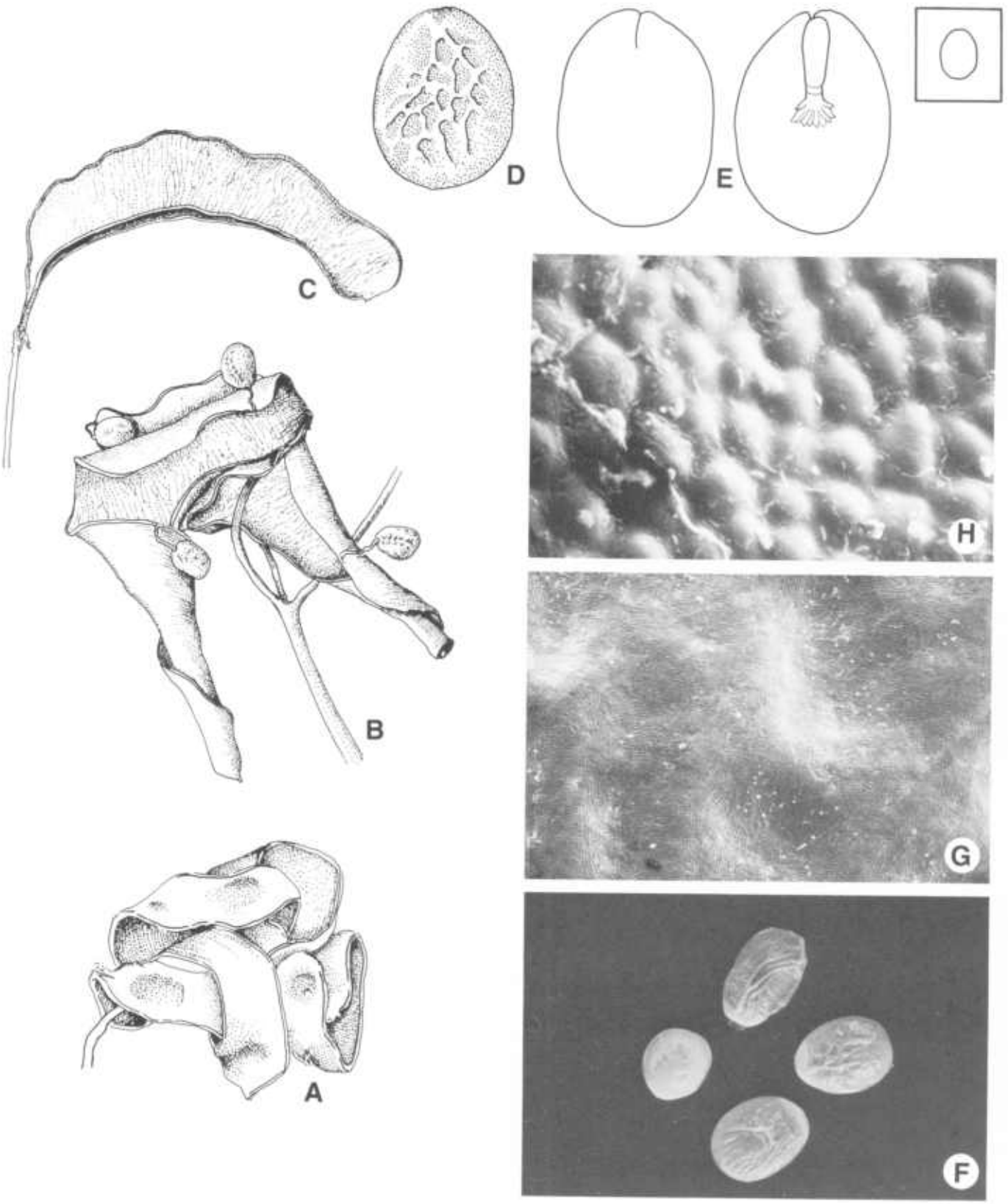
Fruit 9-15 × 1.5-2 × 0.7-0.8 cm, curved, without twists, oblong, margins slightly constricted, rounded to apex, long tapered to base, substipitate, flattened, subligneous. Valves dehiscing apically along both margins and twisting, remaining attached to sutures, with faintly visible seed chambers. Epicarp dull, tannish brown, glabrous, transversely reticulate, not exfoliating. Mesocarp fibrous, subligneous. Endocarp full, purple becoming reddish brown, nonseptate. Seeds 6-7, transverse, not overlapping, in 1 series. Funiculus 5-7 mm long, thick, hooked.

Seed 7-10 × 6.2-7.3 × 4-5 mm, ovate to oblong, compressed. Testa dull, whitish green (green caused by green cotyledons below translucent white testa), rugose to smooth, chartaceous, without pleurogram or fracture lines or wing or aril. Hilum punctiform, exposed, flush, subapical. Lens not discernible. Endosperm absent. Cotyledons with simple split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed.

Distribution: Tropical South America.

Notes: Britton and Rose (*1928*) and Kleinhoonte (*1939*) both noted "seeds with a short, white, fleshy aril (according to Poeppig and Endlicher)." It is understandable that the white translucent testa would be confused for an aril.

Klugiodendron: K. laetum (Bentham) Britton & Killip (*A-H*). *A-C*, Fruits (× 1); *D*, seed topography (× 2); *E*, cotyledons concealing radicle (left) and embryonic axis (right); *F-H*, testa (× 2, × 50, × 1,000).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Genus: Genus D (*Pithecellobium* section Samanea Bentham series Coriaceae Bentham).

Phylogenetic Number: 5.20.

Tribe: Ingeae.

Species Studied - Species in Genus: 2 spp. - at least 2 spp.

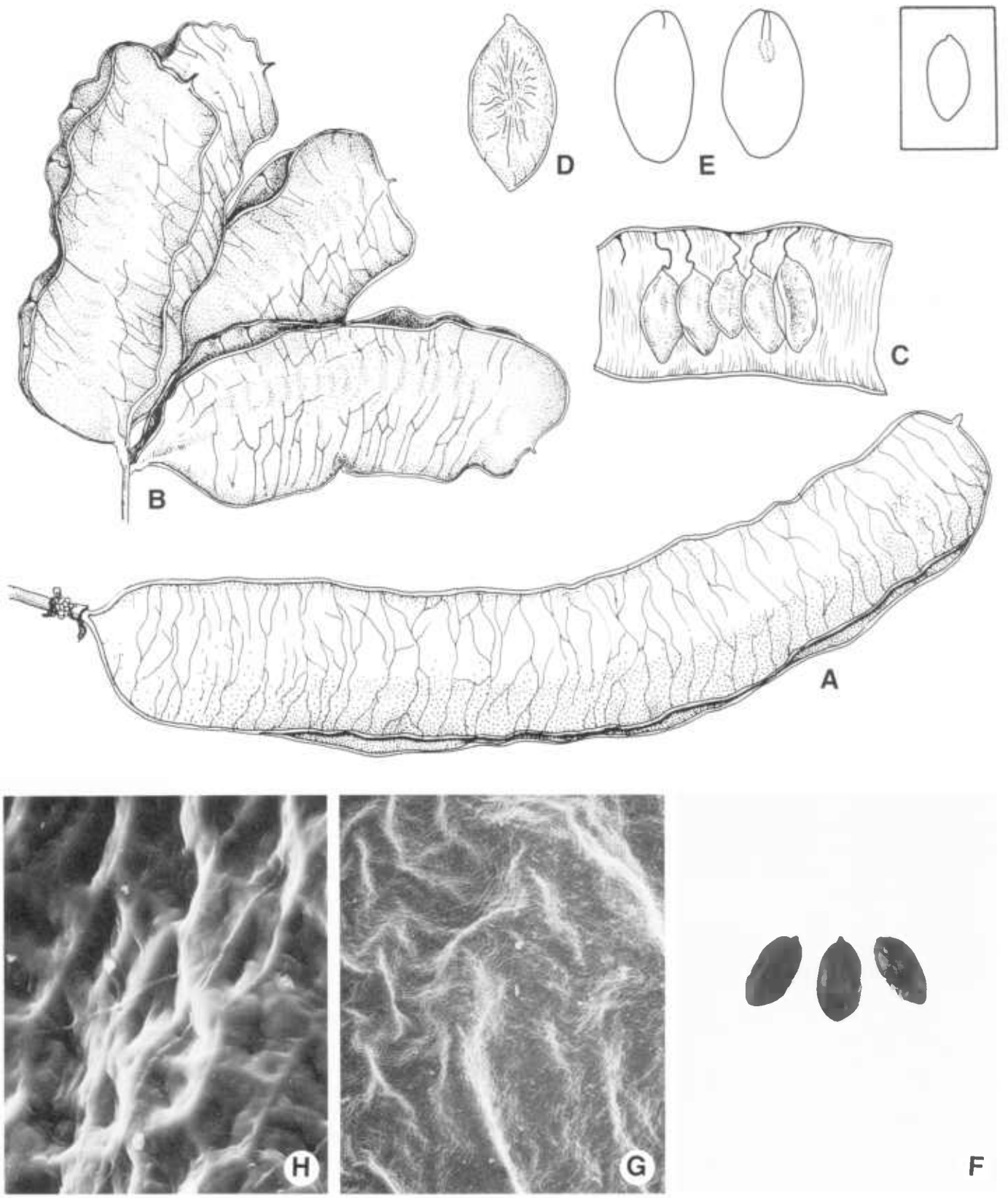
Fruit 7-17.5 × 2.5-3 × 0.3-1 cm, straight to curved, without twists, oblong, slightly constricted, rounded to truncate to apex, rounded to short tapered to base, substipitate, compressed to flattened, coriaceous. Valves dehiscing apically or medially by dorsal margin or both margins, remaining attached to sutures, with or without visible seed chambers. Epicarp glossy to dull, brown, pubescent to glabrous, reticulate, not exfoliating. Mesocarp absent. Endocarp dull, tan, nonseptate. Seeds 12-18, transverse, not overlapping, in 1 series. Funiculus 5-15 mm, filiform, hooked.

Seed 15-18 × 7-11 × 4-5 mm, oblong to elliptic or subcircular, compressed. Testa dull, brown, rugose and shagreen, chartaceous, with minute winglike rim about 0.4 mm wide, without pleurogram or fracture lines or aril. Hilum punctiform, exposed, raised, subapical to apical. Lens not discernible. Endosperm absent. Cotyledons with simple split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed and densely pubescent.

Distribution: Brazil.

Notes: Nielsen (pers. commun., 1982) has not determined the status of the species in Genus D.

Genus D: *Pithecellobium adiantifolium* Bentham (*A*), *P. lindsaefolium* Bentham (*B-H*). *A*, Fruit (× 1); *B*, fruit cluster (× 1); *C*, seeds in situ (× 1); *D*, seed topography (× 2); *E*, cotyledon concealing radicle (left) and embryonic axis (right) (× 2); *F-H*, testa (× 1, × 50, × 1,000).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Genus: *Punjuba* Britton & Rose.

Phylogenetic Number: Unassigned Ingeae genus.

Tribe: Ingeae.

Species Studied - Species in Genus: 1 sp. - ca. 3 spp.

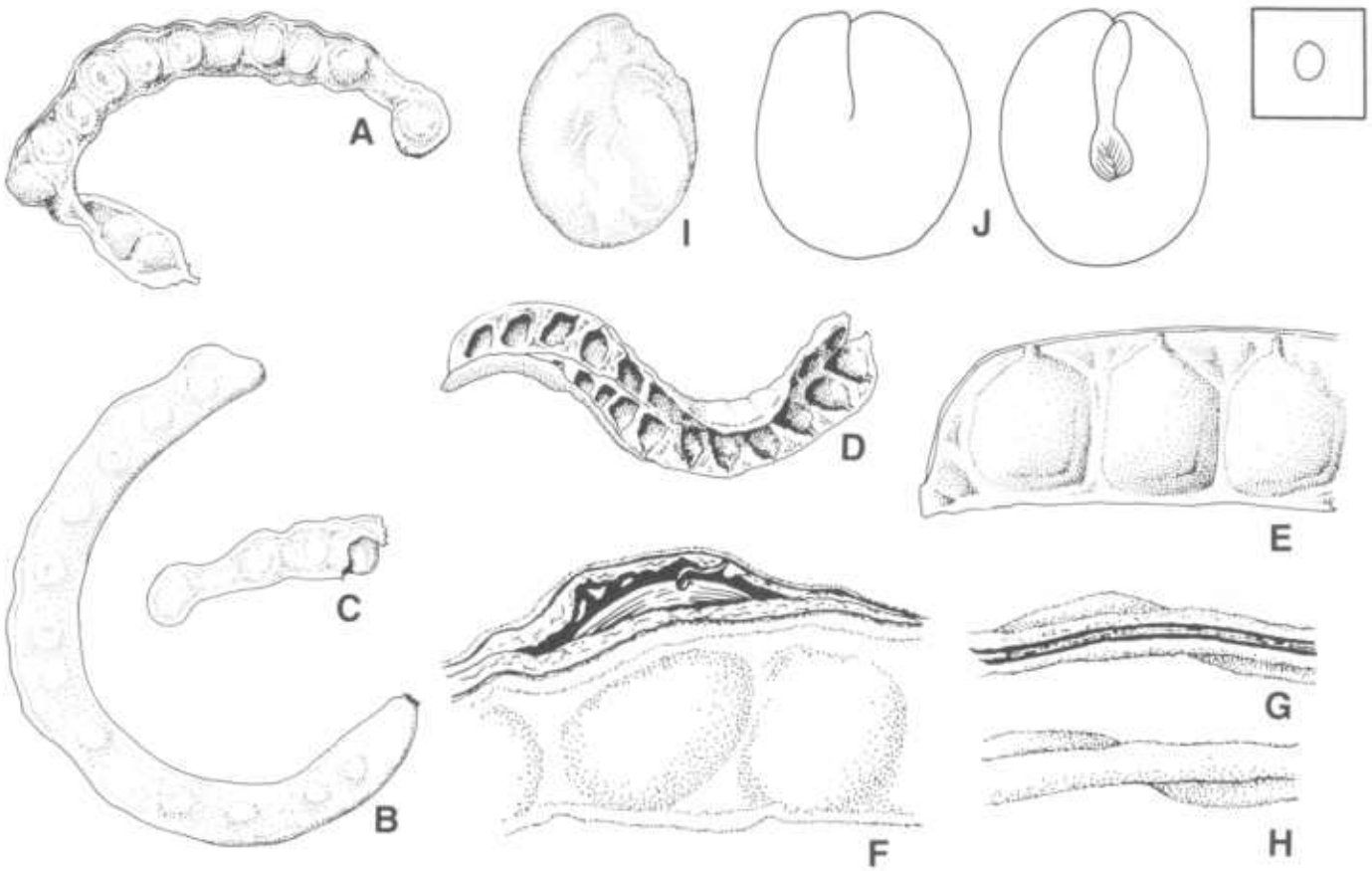
Fruit 9-15 × 0.7-1.5 × 0.8-1 cm, curved to ½-coiled, without twists, linear, margins slightly constricted, rounded to apex, short tapered to stipe 5 mm long, compressed to terete, coriaceous. Valves dehiscing medially by ventral margin bearing 2 distinct lips absent along dorsal margin and eventually opening flat, remaining attached to sutures, with visible seed chambers. Epicarp dull, reddish to grayish brown, densely covered with stellate hairs, shagreen, not exfoliating. Mesocarp absent. Endocarp vitreous and reddish black becoming dull and gray with age, subseptate to septate. Seeds 3-15, oblique, not overlapping, in 1 series. Funiculus at least 2 mm long, filiform, contorted to plicate.

Seed 6.5 × 5 × 2 mm, ovate, compressed. Testa glossy, brown, rugose, chartaceous, without pleurogram or fracture lines or wing or aril. Hilum elliptic to triangular, up to 0.7 mm long, flush, subapical. Lens not discernible. Endosperm absent. Cotyledons with simple split over radicle, concealing radicle. Embryonic axis straight. Plumule well developed.

Distribution: Central and South America.

Notes: The fruit is unusual because the ventral margin is topographically different from the dorsal margin. This is not true for most other mimosoid genera, even when one margin opens and the other remains closed.

Punjuba: P. racemiflora (Donnell-Smith) Britton & Rose (*A-M*). *A-B*, Fruits (× 1); *C*, seed in situ (× 1); *D*, dehiscent fruit (× 1); *E*, seed chambers (× 4); *F*, partial fruit showing open ventral suture (× 3); *G*, ventral suture (× 3); *H*, dorsal suture (× 3); *I*, seed topography (× 6); *J*, cotyledon concealing radicle (left) and embryonic axis (right) (× 6); *K-M*, testa (× 4, × 50, × 1,000).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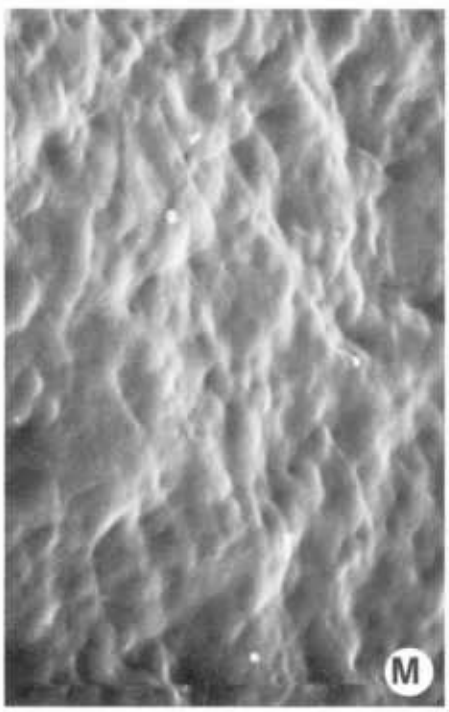
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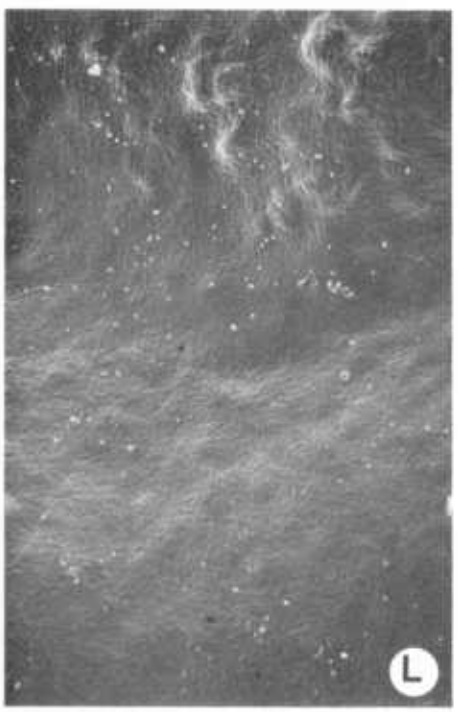
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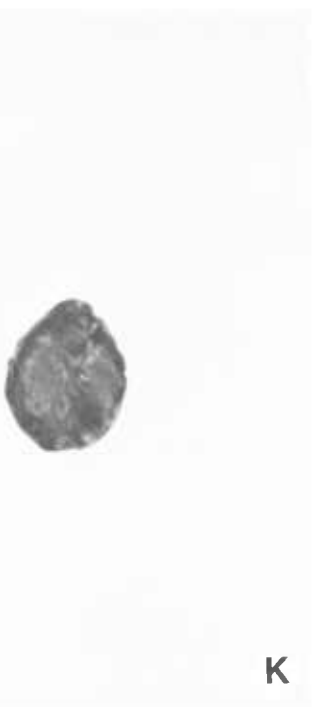
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Species: *Pithecellobium incuriale* (Vellozo) Bentham.

Phylogenetic Number: Unassigned Ingeae species.

Tribe: Ingeae.

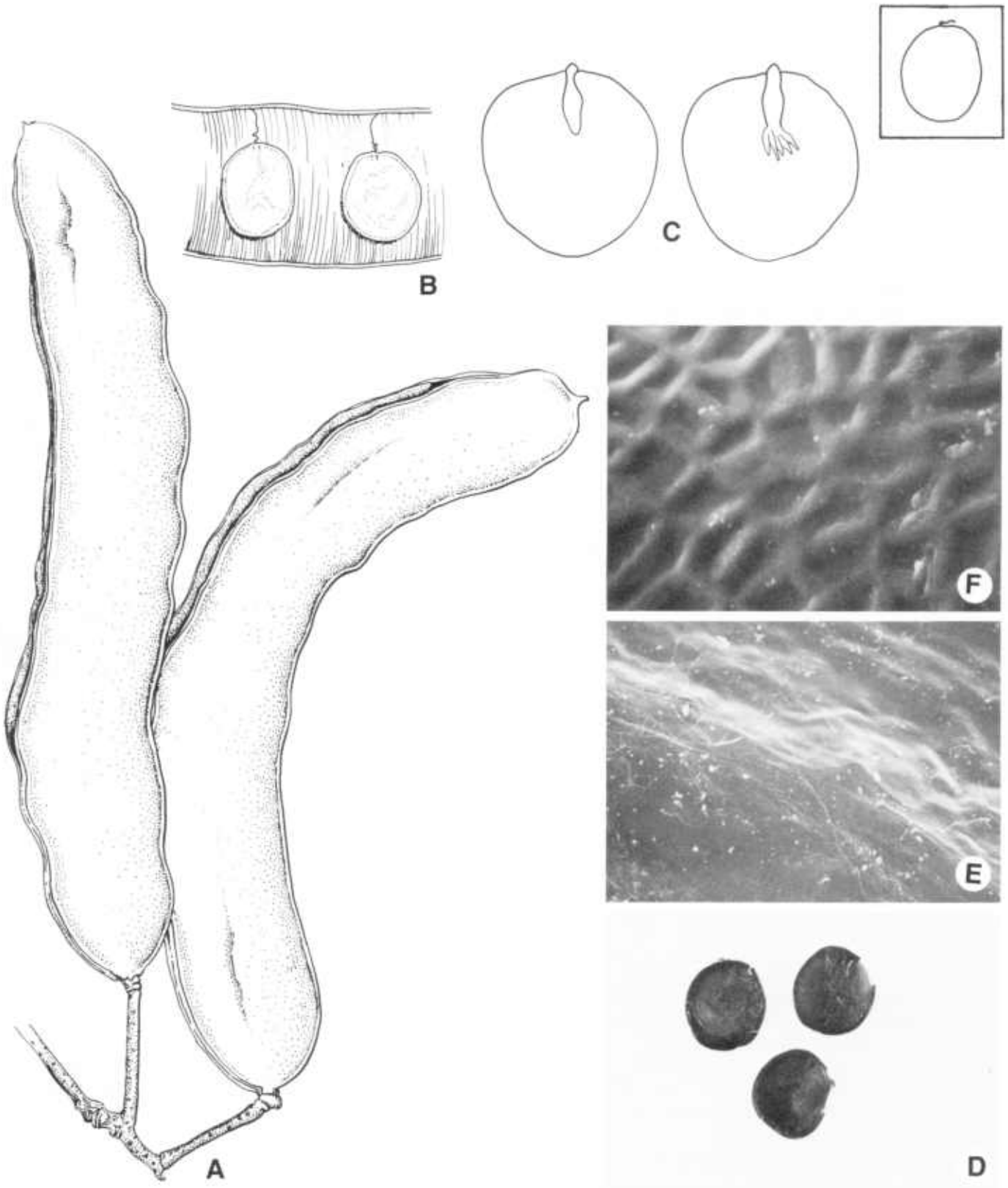
Species Studied - Species in Genus: 1 sp. - 1 sp.

Fruit 15-16 × 2.2-2.5 × 0.2 cm, slightly curved to curved, without twists, oblong, margins not constricted to once constricted, rounded to apex, rounded to base, substipitate, flattened, coriaceous. Valves dehiscing apically by both margins, remaining attached to sutures, with faintly visible seed chambers. Epicarp dull, brown, velutinous to glabrate, faintly transversely reticulate, not exfoliating. Mesocarp absent. Endocarp dull, tan, nonseptate. Seeds 10, transverse, not overlapping, in 1 series. Funiculus 8-10 mm long, filiform, plicate.

Seed 15-18 × 15 × 1 mm, subcircular, flattened. Testa glossy, brown, rugose, chartaceous, with winglike rim about 1 mm wide and darker than body, without pleurogram or fracture lines or aril. Hilum punctiform, exposed, raised, apical. Lens not discernible. Endosperm absent. Cotyledons notched exposing radicle. Embryonic axis straight. Plumule well developed.

Distribution: Brazil.

Pithecellobium incuriale: P. incuriale (Vellozo) Bentham (*A-F*). *A*, Fruit cluster (× 1); *B*, seeds in situ (× 1); *C*, cotyledon not concealing radicle (left) and embryonic axis (right) (× 2); *D-F*, testa (× 1, × 50, × 1,000).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Scientific Name Index